103

S. HRG. 103–368

S. 1537, THE TECHNOLOGY COMMERCIALIZATION ACT OF 1993

Y 4. C 73/7: S. HRG. 103-368

S. 1537, The Technology Commerciali... RING

BEFORE THE

SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED THIRD CONGRESS

FIRST SESSION

OCTOBER 26, 1993

Printed for the use of the Committee on Commerce, Science, and Transportation

MAR 30 19

U.S. GOVERNMENT PRINTING OFFICE

73–521cc WASHINGTON : 1994

For sale by the U.S. Government Printing Office
Superintendent of Documents, Congressional Sales Office, Washington, DC 20402
ISBN 0-16-043481-5

103

S. HRG. 103–368

S. 1537, THE TECHNOLOGY COMMERCIALIZATION ACT OF 1993

Y 4. C 73/7: S. HRG. 103-368

S. 1537, The Technology Commerciali... RING

BEFORE THE

SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED THIRD CONGRESS

FIRST SESSION

OCTOBER 26, 1993

Printed for the use of the Committee on Commerce, Science, and Transportation

MAR 30 19

U.S. GOVERNMENT PRINTING OFFICE

73–521cc WASHINGTON : 1994

For sale by the U.S. Government Printing Office
Superintendent of Documents, Congressional Sales Office, Washington, DC 20402
ISBN 0-16-043481-5

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ERNEST F. HOLLINGS, South Carolina, *Chairman*

DANIEL K. INOUYE, Hawaii
WENDELL H. FORD, Kentucky
J. JAMES EXON, Nebraska
JOHN D. ROCKEFELLER IV, West Virginia
JOHN F. KERRY, Massachusetts
JOHN B. BREAUX, Louisiana
RICHARD H. BRYAN, Nevada
CHARLES S. ROBB, Virginia
BYRON L. DORGAN, North Dakota
HARLAN MATHEWS, Tennessee
JOHN C. DANFORTH, Missouri
BOB PACKWOOD, Oregon
LARRY PRESSLER, South Dakota
TED STEVENS, Alaska
JOHN McCAIN, Arizona
CONRAD BURNS, Montana
SLADE GORTON, Washington
TRENT LOTT, Mississippi
KAY BAILEY HUTCHISON, Texas

KEVIN G. CURTIN, *Chief Counsel and Staff Director*
JONATHAN CHAMBERS, *Republican Staff Director*

SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE

JOHN D. ROCKEFELLER IV, West Virginia, *Chairman*

ERNEST F. HOLLINGS, South Carolina
JOHN F. KERRY, Massachusetts
RICHARD H. BRYAN, Nevada
CHARLES S. ROBB, Virginia
CONRAD BURNS, Montana
LARRY PRESSLER, South Dakota
TRENT LOTT, Mississippi
KAY BAILEY HUTCHISON, Texas

CONTENTS

Page

Opening statement of Senator Rockefeller 1
Prepared statement 11
Prepared statement of Senator Burns 31

LIST OF WITNESSES

Good, Hon. Mary Lowe, Ph.D., Under Secretary for Technology, Department of Commerce 1
MacLachlan, Dr. Alexander, Senior Vice President, DuPont Co 19
Prepared statement 22
Ostfeld, David, Vice President, Career Activities Council, Institute of Electrical and Electronics Engineers 25
Prepared statement 27
Wells, James E., Jr., Associate Director for Energy and Science Issues, General Accounting Office 13
Prepared statement 16

APPENDIX

Federal Laboratory Consortium for Technology Transfer, prepared statement of the 35
Pressler, Senator, prepared statement of 35
Questions asked by Senator Burns and answers thereto by:
Dr. MacLachlan 40
Mr. Wells 42
Questions asked by Senator Pressler and answers thereto by:
Dr. MacLachlan 40
Mr. Wells 45
Questions asked by Senator Rockefeller and answers thereto by:
Dr. MacLachlan 39
Mr. Ostfeld 38
Mr. Wells 37

S. 1537, THE TECHNOLOGY COMMERCIALIZATION ACT OF 1993

TUESDAY, OCTOBER 26, 1993

U.S. SENATE,
SUBCOMMITTEE ON SCIENCE, TECHNOLOGY,
AND SPACE OF THE COMMITTEE ON
COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The subcommittee met, pursuant to notice, at 2:47 p.m., in room SR–253 of the Russell Senate Office Building, John D. Rockefeller IV (chairman of the subcommittee) presiding.

Staff members assigned to this hearing: Patrick H. Windham, senior professional staff member; and Louis C. Whitsett, minority staff counsel.

OPENING STATEMENT OF SENATOR ROCKEFELLER

Senator ROCKEFELLER. Secretary Good, what I would like to do today, in view of, No. 1, your need to be at the Pentagon and, No. 2, your willingness to come here when you really had other things to do is to do something that every witness dreams about, and that is I will not give an opening statement.

Dr. GOOD. Oh, my goodness.

Senator ROCKEFELLER. See. So, I am going to directly to you. And I will make my opening statement at some point, but it is not going to be on your time.

STATEMENT OF HON. MARY LOWE GOOD, Ph.D., UNDER SECRETARY FOR TECHNOLOGY, DEPARTMENT OF COMMERCE

Dr. GOOD. Thank you very much, sir. I really do appreciate that. And I do apologize for having to run, because it is a topic that we are very much interested in, as you know.

I really appreciate the opportunity to be here and to testify today. My remarks are going to be relatively brief, but I did want to take a few minutes to appear here and to begin what I believe is an important dialog on a critical aspect of our Nation's technology policy.

You have focused on one of the central policy issues associated with our current thrust to improve the competitiveness of American industry. How we manage the intellectual property arising from federally supported research and development is central to our success in any effort to promote the early commercialization of new technology.

Furthermore, the timing of your attention to this subject is opportune. We are seeing a fundamental shift in technology policy

under the Clinton-Gore administration. Our focus is moving increasingly away from technology transfer and mission spinoff, and more toward precommercialization and public-private partnerships that are linked more directly to job creation and long-term economic growth. Our administration is rethinking our Federal R&D priorities at a very strategic level, and we are staking a new direction in technology policy while continuing our longstanding commitment to basic science in a variety of fields.

Mr. Chairman, I approach the subject of your hearing today from a variety of backgrounds. As you may know, I started my career in academia, taught chemistry and conducted research at Louisiana State University for more than 25 years, so I had some interest in this problem at that point. I have a deep understanding of the culture of basic research, an experience that culminated in my chairing the National Science Board that oversees the direction and programs of the National Science Foundation.

I am also an inventor and I do, in fact, own several patents. Significantly, I also approach these issues from my experience in the private sector, where I have had hands-on responsibility for the commercialization of new products, processes, and designs.

My first job with Allied-Signal was serving as director of the UOP Research Center. A substantial part of its business was the development of strategic R&D. Much of our work was patented, and a significant portion of our business was the licensing of these technologies, both domestically and in the global marketplace. And later as senior vice president for technology, I managed a number of the corporate laboratories and dealt extensively with our Federal laboratories, particularly those at the Department of Energy, Commerce, and Defense, as well as those at NASA.

So, now, as the Under Secretary charged with civilian technology, I confront a number of key issues related to our Nation's competitiveness. Certainly one of these is the issue of our Government's policy on intellectual policy arising out of Federal R&D. As I understand it, your legislation makes three changes to current Government policy.

First, in the case where an invention arises out of a joint venture between a Government lab and a private sector participant, your legislation would have title to that invention vest entirely with the private sector. Under current practice, the Government and the collaborator have the flexibility to negotiate such title.

Second, your bill establishes, in situations arising under CRADA's, the Government's right to march in where CRADA-generated technology is owned by a private sector collaborator. If the technology is not being effectively commercialized, your bill gives the Government the ability to have the technology licensed to assure that the technology is used.

This is a significant change from current CRADA policy, where such march-in rights on the part of the Government exist only with respect to Government-owned technologies that have been exclusively licensed to private sector collaborators. If I understand what your legislation is trying to do, you are trying to have the CRADA approach to march-in rights more closely approximate the model of the Bayh-Dole Act.

The third change made by your proposal is regarding royalty income to the laboratories. Your proposal specifies how royalty income will be allocated and used by the Federal lab when it licenses or assigns its inventions to the private sector. Under current practice labs have the flexibility, both in how they reward employees and use these funds to support technology transfer activities and reimburse their expenses under the CRADA.

As I pointed out to you in my letter last week, with such short notice I was unable to prepare a complete review of the legislation and present an administration view today. I say this even as I acknowledge that I am a big believer in implementing our own Baldridge Award principles at the Department of Commerce, particularly timely customer response.

Yet you have begun a very important dialog. As we work together in the coming months to address the critical issues of how our IPR policy works in tandem with our technology policy, I hope we can begin to explore some answers to the following questions.

One key question is what are the appropriate benchmarks in measuring the success of our Federal labs in working with the private sector to achieve the objectives of job creation and long-term economic growth. Certainly one of those benchmarks is, as you have pointed out, the degree to which our labs are creating and licensing inventions. It cannot be the only benchmark, and it can be a somewhat misleading indicator in some technologies in certain areas.

Universities have a much longer track record of creating and licensing inventions arising out of Federal R&D, going back to 1980 with the passage of the Bayh-Dole Act. And we had a hearing yesterday on the Bayh-Dole Act for a large group of university people, and they are still very much in favor of it, as you might imagine.

The so-called GOGO's, or Government-owned, Government-operated labs, were given this authority 6 years later under the Federal Technology Transfer Act of 1986. Now only in 1990, just 3 years ago, was the same authority clarified to include the so-called GOCO's, the Government-owned, contractor-operated labs. Quite often, it will take a significant time period to have patents incorporated into actual products, and royalty income, depending on the agreement, will often follow several years later as well.

Moreover, much of the collaboration between the labs and the private sector is in areas that we may not want to have patented and therefore restricted to a broader industrial audience. For example, the Department of Commerce's own National Institute of Standards and Technology is the Government lab for standards development. Any particular standard that is developed out of collaboration with the private sector will affect all companies in a given industry, and may affect many industries, and we would like to have that distributed as widely as we can.

The most significant benchmark, in my view, is the perception by the private sector of any particular lab's potential contribution to solving a problem relative to the difficulty of doing business. My own personal experience in working with a variety of labs is that the likelihood of success in negotiating a successful contract and carrying out a successful partnership depends on whether the culture of the lab and its employees is open to such collaboration,

based on the lab's core competency and primary mission. Streamlining the CRADA process and looking at issues like IPR are part of aiding that culture to be more responsive to the private sector, but, by themselves, they will not solve all of the problems.

There are many other questions, but this is clearly one of the most important. Your efforts to begin this important dialog represent an important step. We must begin to examine how our governmental intellectual property laws and policies are integrally related to enhancing U.S. technological competitiveness, rather than just tools of a regulatory system reactive to technological change. We need to start viewing the intellectual property we create through our investment of R&D as itself a critical technology.

Thank you very much, and I have a few minutes that I would be happy to try and answer questions, and then I am going to have to depart, as I told you. Thank you.

Senator ROCKEFELLER. Well, I tell you what, I am just going to keep shooting questions at you and when you have to go, you just get up and leave.

Senator Burns, Secretary Good has been good enough to come here at all and she has got to be at the Pentagon very very quickly, so I did not even make an opening statement. And she has just finished her testimony and I am going to fire some questions at her, if that is OK.

Senator BURNS. That is fine.

Senator ROCKEFELLER. Thank you. Thank you. [Laughter.]

Was it important to Allied-Signal, for example, when you were there, that it have control of the intellectual property that it was commercializing?

Dr. GOOD. Absolutely.

Senator ROCKEFELLER. And why? Tell me why?

Dr. GOOD. Well, the reason is very straightforward. Most of the technology developed at that level still requires enormous investment. The development half is more costly than the research, and unless you have control over that technology and can get your money back out of the development investment, you are not likely to put your money in that particular product. It is just a business issue.

Senator ROCKEFELLER. Right. Do you think intrinsically, one way or another, that Federal laboratory directors are better able or much less able to decide what technology should be commercialized and how they should be commercialized compared with the technology managers from American industry? Can you, as you have seen them, describe the merits?

Dr. GOOD. Well, that is a little bit of an unfair question, but I will answer it.

Senator ROCKEFELLER. But it is important.

Dr. GOOD. It is very important. And it is a little bit unfair with respect to the laboratories because the industrial R&D people, that is their job, is to commercialize technology. And if you do not get reasonably good at it, you end up doing something else because people ask you to do something else. So, the issue with the laboratories is how do they perform their dual mission—so I think there is really no question that in terms of commercializing and how to

commercialize the ideas, the industry probably has lots of information that the laboratories simply do not have.

Senator ROCKEFELLER. But let me put it in a different way, then. In the Federal laboratories, for example, DOE, you can negotiate CRADA in 2 years if you are lucky. If you want to do it with NIST, you can do it in 2 weeks. So, there is obviously a big differential among the Federal people who make these kinds of decisions.

Dr. GOOD. That is correct.

Senator ROCKEFELLER. That is all I am going to get?

Dr. GOOD. Yes. [Laughter.]

Yes, there is a very big difference——

Senator ROCKEFELLER. What is the culture difference? Take the DOE and NIST difference?

Dr. GOOD. The big difference is the fact that—and to use them specifically, NIST has always had as part of its mission the need to interact directly with the industry. So, to them that is what they do for a living. The national laboratories were really created for a different mission, and today they are trying to change that culture to something similar to what NIST has, and it takes a while to get there.

Senator ROCKEFELLER. And does that imply that if it becomes increasingly Government policy that Federal laboratory people will engage more with private laboratory people, as I think we will see in this administration, that the difference between the private and the public, while it may never close, could possibly get closer?

Dr. GOOD. It could get a lot closer. It could get a lot closer. The comment I made to several groups in recent days is that technology transfer is a body contact sport. Technology gets transferred by people, not by reports and throwing things over the wall. So, you have to learn how to work with people in partnership arrangements to make these really work and to take the timelag out. And in today's world the timing of how you get the technology is as important as the technology itself. Because if I get a technology out that is 6 months behind my competition, it is as if it did not exist almost.

Senator ROCKEFELLER. I just had lunch with a remarkable man whom I revere in many ways, but who thinks that the Federal Government is just something this country should more or less do without, that almost anything they touch turns to dishwater. Now, the fact that this fellow is a Federal employee obviously makes the argument somewhat more difficult, but there is that assumption, is there not, on the part of industry, that Government cannot do things right?

I have noticed, I believe, in the Congress the beginnings of a difference in the way we, as Congresspeople, are beginning to react to situations. For example, I find that Democrats are more willing to vote "no" on social programs and other programs than, let's say, we would have 2 or 3 years ago. That we are more willing, in other words, to change our behavior because the circumstance of the country requires that and that, in fact, people can adjust.

So, what I guess I am asking you is, do you think that the culture of distrust in private business toward Government is changeable? Particularly in view of the fact of an article that I can never forget. It was in Fortune magazine, I think, two Decembers ago, in

a "whither America" type of Fortune magazine series of articles, and they asked about 100 key chief executives what they thought the role of Government should be or should not be.

And I would say 70 of them said the Federal Government has to take the lead on where we are going. We cannot know and be predictive about where we are going unless we have a sense of where they are going, what are their policies going to be, what direction are they taking. And it was quite stunning, actually. This is across the board from Steve Jobs to all kinds of other people.

So, regarding this question of the assumption that Government people cannot do anything right, does your experience in Government hold out some promise that maybe that could be not fully the case?

Dr. GOOD. Well, I have to tell you, Senator, I would not be here if I believed that.

Senator ROCKEFELLER. Yes.

Dr. GOOD. No. First of all, I think that there is real promise in utilizing some of the things that we have made major investments in over the last 50 years. And the issue is how do we do that appropriately. We have made major investments in big R&D facilities here in the United States. We have made big investments in people, highly trained people, all of whom can make a contribution to the whole issue of this competitiveness thing we are talking about. And the issue is how do we arrange it so they can and how do we make it effective? And that is part of what your bill is all about, and I think that is absolutely the question.

Senator ROCKEFELLER. So, in a sense, the doing of things, of relationships, may change the culture and the perception.

Dr. GOOD. Absolutely. And in fact, Senator, I would say that is the only way you change it. We do not change it by saying we are going to; we change it by actually doing some things that make a difference.

Senator ROCKEFELLER. You probably are going to have the responsibility for writing the implementing regulations for this bill should it, hopefully, pass.

Dr. GOOD. Right.

Senator ROCKEFELLER. Do you foresee a problem dealing with the legislative requirements, one, for "reasonable compensation" to the laboratory; two, for Government use; and, three, for the so-called Government march-in rights that you referred to?

Dr. GOOD. No. The Government march-in rights are somewhat different from the other two provisions. I think that the public has a right to do that in the following sense. If you have a technology which you have licensed or that is partially supported by the Federal Government, and if the industry does not use it but it is technology that really has promise and is in the best interests of the public, then you ought to have a right to take it back and license it to somebody who will invest in it and move it.

Senator ROCKEFELLER. Philosophically, why do you think that it is not wrong for Government and private industry to be working together in areas where it seems appropriate? Obviously, this new car venture is one example. If you just had to make a statement of why it is OK, because there are a lot of people who believe we should just reject it out of hand.

Dr. GOOD. That is right. Well, I think the car one is a good one to look at, because there are people who believe that that is not an appropriate thing to do. But if you think about why you want to do that, the reason you want to do it is in the public good ultimately. Because we really do need to make the improvements that we need to make in the environment, and we really do need to make the improvements in fuel consumption. That is in the public good. If we can, at the same time, do that in such a way that American industry can take advantage of it, we win both times.

Senator ROCKEFELLER. Let me ask two more questions, then I will yield to my colleagues, and then come back with more if you have time.

Do you think the provisions for "reasonable compensation," Government use, and march-in use protect the public's interest in this jointly developed technology?

Dr. GOOD. Clearly, it does if you have very good management in the Government side to understand when and how to apply those things.

Senator ROCKEFELLER. OK. Can you just go on a little bit about that?

Dr. GOOD. Well, for example, on the march-in rights, you need to understand what the technology is, how it might be applied elsewhere, and you need to understand why it is not being commercialized at the present time by whoever has control of it.

It may be that it really is before its time, and no one is going to put money in it. But it could be that the company that has the rights to it simply does not have the wherewithal at that point in time to pursue it. So, you really need to understand how these things work if you are going to make good decisions.

Senator ROCKEFELLER. Do you hear any talk out there at all about this bill or, if not about the bill, about the concepts that this bill embraces?

Dr. GOOD. Clearly, we hear a lot today about how to manage the intellectual property rights that come out of federally funded research. It is a major topic. It is a topic for the ATP programs. It is a topic for the reinvestment program at DOD.

Senator ROCKEFELLER. When I said talk about, I meant out in the private sector, not the public sector.

Dr. GOOD. Oh, sure. The private sector talks about these programs because they make decisions as to whether they will participate in them, based on what their rights will be. They clearly decide, in things like the ATP program, whether they will participate or not, dependent upon what rights and so forth they can negotiate. And if they believe the rights they have negotiated are adequate for them to move that technology forward if they are successful.

Senator ROCKEFELLER. So, what they need, then, is a certain level of predictability that they can count on?

Dr. GOOD. That is right.

Senator ROCKEFELLER. Now, I am not asking you to endorse the bill at this time because you would not, even if I asked you to, because the administration has not taken a position on all of this. But is not laying down in language and setting out the rules, making them clear, even in statute, one of the ways that you create a climate of predictability to empower the private sector?

Dr. GOOD. Clearly, that is right. And I think that is the reason why I think you really should be applauded for putting this bill on the table. Because it gets the conversation started. We really need to move forward and to at least come to some set of principles on how we wish to proceed.

Senator ROCKEFELLER. OK.

Dr. GOOD. Because that is the only way that people can take maximum advantage of the activities and so forth that go forward.

Senator ROCKEFELLER. Can you think of some areas, from your various background, where you just reflect upon how useful it would have been had the private sector and the Government been working together?

Dr. GOOD. It is a little hard to pick specifics at this point. But I can put some together for you over a bit of time. I would rather not trot them out without thinking about them carefully. But, particularly in some of the areas where Defense Department technology was being developed and the opportunity to use that in other sectors, for example. We clearly had some opportunities like that.

Senator ROCKEFELLER. Do you not think the automobile and the so-called new car or the flexible-fuel engines have just been crying out for cooperation, even if it is only that the Government says to the three majors, go ahead and do it, much less that the Government be involved with it?

Dr. GOOD. Oh, I do not think there is any question it is going to help to say it is OK to go ahead and try these things.

Senator ROCKEFELLER. Yes.

Dr. GOOD. OK.

Senator ROCKEFELLER. Senator Burns.

Senator BURNS. I just have a couple of observations, Dr. Good. And thank you for coming today. NIST does do a good job of working with industry, because they are also in this business of standards and getting people to talk to one another so that industry can move on.

With regard to the labs of this country, should they be talking to NIST and saying, OK, help us transfer our technology?

Dr. GOOD. Well, remember, it is different. The technology is somewhat different. When you are talking about standards, you are working with a whole group of industry people and you are trying to disseminate information, much of the work you would like to see and that the laboratories are able to do is in a specific technology, where you really are going to look at that as to eventually make a product that you are going to sell. OK.

And there you are interested in having some control over that technology so you can bring it out and make some money on it eventually.

Senator BURNS. I have always said that we can out-technology the world. Where we cannot get it done, it seems like, we cannot get it from the drawing board into the consumer's hands once it has been proven and proved out.

Dr. GOOD. Right.

Senator BURNS. And I think this legislation is trying to—or struggling, and I am not real sure it is there yet, to be quite honest with you—to enable that to happen. I am not real sure that it is

the Government's place to do business with the car companies in the production of the car. I think we do not know how to build cars.

Dr. GOOD. Can I just comment on that?

I would agree with you absolutely. And that was one of the questions that we were asked on the car initiative. The technology development is going to be in the precommercialization phase, but who ends up building the car that is going to sell to you and your wife is going to be the guy who has the innovation and the skill and the design.

So, the competition is still going to be there, and we do not want to take that away.

Senator BURNS. I still think it is going to be a market-driven thing.

Dr. GOOD. It must be.

Senator BURNS. Now, we can do some things with ceramics and materials. And Senator Rockefeller here, using his foresight—and we had a hearing on new materials and how things will be made in the future—and I think there is where we can probably make the most impact. Because, once that is done, we have lighter engines and we have a lot of things, and even over in the electric cars.

I am not real sure that the technology is there to build an electric car that will be any more energy efficient than what we have right now. Because somebody is going to have to produce a battery. And somebody is going to have to charge them.

Dr. GOOD. That is right.

Senator BURNS. And that takes another power transfer, so to speak.

Dr. GOOD. That is true. And, in fact, the thrust really ought to be on looking at whether you really can get a leapfrog technology on those issues.

Senator BURNS. That is exactly right.

Thank you for coming today, and I know you have somewhere else to run off to.

Dr. GOOD. Thank you very much.

I do. And I do apologize for having to run.

Thank you very much, sir.

Senator BURNS. Thank you.

Senator ROCKEFELLER. Thank you, Dr. Good. Thanks an awful lot.

Our panel is made up of Dr. James E. Wells, Jr., who is Associate Director for Energy and Science Issues at the U.S. General Accounting Office, accompanied by Ms. Amy Manheim, who is a GAO expert on technology transfer; second, Dr. Alexander MacLachlan, who is senior vice president, DuPont Research and Development out of Wilmington; and also, Mr. David M. Ostfeld, who is vice president Career Activities Council, Institute of Electrical and Electronics Engineers in Washington, DC.

Now, I have to confess to a weakness, Senator Burns. And that is that I want to give my statement. And these good four people are just absolutely stuck right out there, and they are going to have to listen to it. And I beg your and Senator Lott's forgiveness on this. It really is not very long, but I do want to say a couple of things.

We introduced this bill earlier this month to try to promote greater cooperation between our 700 Federal research laboratories and U.S. industry. It is part of efforts that I and others have made over many years and on many fronts to advance American economic competitiveness and increase cooperation between Government and industry. It strikes me as not unreasonable. It is essential in this drive to build a better economy for all of us. I do not consider theology ought to rule in this. I consider what is best for inventions, what is best for people, however that works out.

It seems to me this cooperation will allow our manufacturers, their workers, and the economy as a whole to reap the fruits of the $25 billion that we spend annually on research and development at our Federal laboratories. I think most people have absolutely no idea that we spend that kind of money.

While drafting this bill, we consulted extensively with U.S. companies, with the Federal agencies and laboratories, with scientists and engineers, and with the General Accounting Office. This hearing, therefore, is an effort to draw on all of these viewpoints through the distinguished panel that you are.

As you all know, when it comes to technology commercialization, the track record of Federal laboratories is not good. In light of this, I will ask the witnesses why this is the case, and whether the bill which I am putting forward would improve that record.

While I truly want your views on these issues, let me also briefly share my views with you. It is my firm belief that commercialization of technology and industrial innovation in the United States is more likely to occur when the private sector, rather than the Government sector, has title to the technology.

In our economy, commercialization depends upon actions by business, not Government. With ownership, businesses are more prepared to undertake the expenses of commercialization, including the expense of the research itself.

The Stevenson-Wydler Act allows Federal laboratories to claim ownership to a technology jointly developed by the lab and private research partners under cooperative R&D agreements, which we call CRADA's. The many research-intensive U.S. companies that we contacted in preparing S. 1537 told us that this labs' option to claim ownership has retarded the commercialization of the technology. In other words, the Federal labs, having that ability, retarded their interest in doing joint venture work.

I also want to make clear that I do not view this bill as a Government giveaway program. First of all, the Federal Government will retain a paid-up, irrevocable license for its own use of any technology developed. Second, the bill requires that the private partner gets title "in exchange for reasonable compensation to the laboratory."

I believe this provision, in addition to putting technology in the commercial sector where it can be commercialized, will greatly speed the negotiation of CRADA's.

Under current practices, the most time-consuming and often deal-breaking part of the negotiation between Federal laboratories and the potential research partners in the private sector is over the ownership, the assignment, the licensing, the restrictions, et cetera, of the intellectual property rights.

S. 1537 eliminates this obstacle. The companies will own the rights, and can commercialize in all areas of use.

Another provision of the bill will also help simplify and speed up the negotiations, while at the same time protecting the public's interest in technology that its tax dollars have helped to develop. It is the so-called march-in rights that the Government will retain in the intellectual property assigned to the private partner.

Under this provision, the laboratory can assign the license to another company if the titleholder does not commercialize the technology or does not manufacture in the United States.

This bill also beefs up the incentive program already in the Stevenson-Wydler Act for lab scientists. A recent GAO report indicates that the current royalty-sharing system has not had the desired impact on scientists' interest in patenting and commercializing, which is fairly basic—if they are not interested, they are not going to do it.

GAO's recommendations to improve the situation are incorporated in this bill.

In my longer written statement which I will make part of the record, I have shared the views of some U.S. companies that have written to me about the bill. And I am very pleased to say to my colleagues here, too, that these comments have been very positive.

I will stop there.

[The prepared statement of Senator Rockefeller follows:]

PREPARED STATEMENT OF SENATOR ROCKEFELLER

Welcome to this hearing on S. 1537, the Technology Commercialization Act of 1993. With Senator DeConcini as cosponsor, I introduced this bill earlier this month to promote greater cooperation between our 700 Federal research laboratories and U.S. industry. It is part of my efforts over many years and on many fronts to advance American economic competitiveness. Increased cooperation between government and industry is essential in this drive to build a stronger, more competitive economy. This cooperation will allow our manufacturers, their workers, and the economy as a whole to reap the fruits of the $25 billion that we spend annually on research and development at Federal laboratories.

While drafting this bill, we consulted extensively with U.S. companies, with the Federal agencies and laboratories, with scientists and engineers, and with the General Accounting Office. This hearing is an effort draw on all of these viewpoints through our distinguished panel of witnesses.

As all of you know, when it comes to technology commercialization, the track record of Federal laboratories is not very good. This has been well documented by the GAO. In light of this, there are four main questions I would like the witnesses to address, if not in their opening remarks then in subsequent answers to the subcommittee questions:

1. What factors currently inhibit collaboration between Federal laboratories and American industry?

2. Would the enactment of S. 1537 simplify the process of negotiating cooperative agreements and lead to more collaborative research efforts?

3. Do the bill's provisions on reasonable compensation to the laboratories and the government's march-in rights ensure that the public's interest in jointly-developed technologies is protected?

4. Will the proposals to put the technology in the hands of U.S. industry and to enhance the laboratory incentive system result in greater commercialization of technology?

While I truly want your views on these issues, let me also briefly share my views with you. It is my firm belief that commercialization of technology and industrial innovation in the United States is more likely to occur when the private sector, rather than the government, has title to the technology. This conclusion should not be surprising. In our economy, commercialization depends upon actions by business, not government. With ownership, businesses are more prepared to undertake the expenses of commercialization, including the expense of the research itself.

The Stevenson-Wydler Act currently gives Federal laboratories an option to claim ownership to technology developed jointly by the lab and private research partners under cooperative R&D agreements, what we call a CRADAs. This is in spite of the fact that the private partners provide all of the financing and most of the resources that go into the research. It appears that the labs' ability to claim ownership of intellectual property developed jointly with American industry has retarded the commercialization of the technology. That's the view of the many research-intensive U.S. companies that we contacted in preparing S. 1537.

I also want to make clear that I do not view this bill as a government give-away program. First of all, the research conducted in CRADAs is of interest to both partners, and the Federal government will retain a paid-up, irrevocable license for its own use of any technology developed. Secondly, the bill requires that the assignment of title to the private partner be made "in exchange for reasonable compensation to the laboratory." I have not chosen to legislate in detail what this compensation should be, because the details should be left to the negotiators of the agreement to decide. It could range from an agreement to reimburse the laboratory for its direct research costs to an agreement to share in the income from the invention.

I believe this provision, in addition to putting technology in the commercial sector where it can be commercialized, will greatly speed the negotiation of CRADAs. Under current practices, the most time-consuming—and often deal-breaking—part of the negotiation between Federal laboratories and the potential research partners is over the ownership, assignment, licensing, restriction, etc. of the intellectual property rights. S. 1537 eliminates this obstacle. The companies will own the rights and can commercialize in all areas of use.

Another provision of the bill will also help simplify and speed up the negotiations, while at the same time protecting the public's interest in technology its tax dollars helped develop. It is the so-called "march-in rights" that the government will retain in the intellectual property assigned to the private partner. Under this provision, the laboratory can assign a license to another company if the title holder does not commercialize the technology or does not manufacture it in the United States.

The bill also beefs up the incentive program already in the Stevenson-Wydler Act for lab scientists. A recent GAO report indicates that the current royalty sharing system has not had the desired impact on scientists' interest in patenting and commercializing. GAO's recommendations to improve this situation are incorporated into the bill.

Before hearing your views, I would like to share with you the views of some U.S. companies who have written to me about the bill.

Dr. David A. Duke, Vice Chairman of Corning, wrote, "I have received through the National Research Council a draft copy of your proposed legislation amending the Stevenson-Wydler Technology Innovation Act of 1980 and would like to commend you on your support of technology transfer between the government and the private sector. The basic premise of the draft, that title to intellectual property developed under a CRADA is assigned to the collaborating company, has Corning's complete support. It will place control in the hands of the private sector parties who must commercialize the technology."

Although we will hear in a few minutes from Dr. MacLachlan of Du Pont about the bill, I want to read the remarks of another Du Pont official because they are so succinct. Dr. James Forstner, Du Pont Corporate Counsel and technology guru, wrote: "We believe passage of this bill is in the national interest. It would encourage participation of U.S. enterprises in CRADAs, and this in turn could enhance our international competitiveness."

Dr. Andrew Pettifor of Rockwell, who is the Chairman of the Industrial Research Institute's Federal Science and Technology Committee, wrote, "The amendment is designed to ensure that the intellectual property rights created in CRADAs between industry and national laboratories flow more easily to the industry partner than is currently the case. The expected benefits include speedier CRADA negotiations and increased interest by U.S. industry in collaboration with the national labs."

Dr. Glen Allgaier, Executive Manager for Technology Development of Eaton Corporation, wrote, "Speaking from personal experience, we have been very frustrated here at Eaton in our efforts to establish CRADAs that will allow proper sharing of information and technology. * * * I am writing to let you know that we are very supportive or efforts that can speed up this technology transfer process. We are anxious to work with government labs and feel that access to that technology can help strengthen our efforts to grow the economy."

Dr. Victoria Haynes, Vice President for Research and Development of B.F. Goodrich, wrote, "* * * relating to the bill to amend the Stevenson-Wydler Act to promote faster commercialization of jointly developed technologies. * * * I am in full support of this proposed legislation * * *"

Bruce Handler, the founder and former CEO of Eeonyx, a private, high-tech corporation in California, wrote, "I would argue that the present statute is not only a disincentive to cooperation, but * * * [also] a structural discouragement to entrepreneurial activity and technological risk-taking, and to the availability of capital * * * Can this be reconciled with our national needs for global competitiveness? I think not. Senator, your proposed * * * bill fixes the problem."

With these keen insights still ringing in my ears, I will ask my colleagues on the Subcommittee if they have opening remarks and then turn to Dr. Mary Good, who has interrupted the negotiation of a very important collaboration between our Federal laboratories and the U.S. automobile industry to be with us today.

The views of Dr. Good are especially valuable as she has led the R&D efforts of a major U.S. corporation and is now responsible for managing the technology policy of the entire U.S. Government, not just the technology programs of the Department of Commerce where she is the Under Secretary for Technology. From our previous discussions, I know she supports the goals of public-private partnership, job creation, and long-term economic growth that are the basis of both the Technology Commercial Act of 1993 and the Clinton Administration's technology policy.

Senator ROCKEFELLER. Senator Lott, are there any comments that you would like to make?

Senator LOTT. Not at this time. I would just like to hear the witnesses' testimony.

Thank you, Mr. Chairman.

Senator ROCKEFELLER. All right. I get the point. Mr. Wells, should we start off with you, sir?

STATEMENT OF JAMES E. WELLS, JR., ASSOCIATE DIRECTOR FOR ENERGY AND SCIENCE ISSUES, GENERAL ACCOUNTING OFFICE; ACCOMPANIED BY AMY MANHEIM

Mr. WELLS. That would be fine. Thank you.

Mr. Chairman, members of the subcommittee, as I begin, let me introduce my coworker, Ms. Amy Manheim, who is our evaluator in charge, and who actually did the work on this assignment.

Mr. Chairman, we are pleased to be here today to discuss the results of our earlier work—"Technology Transfer Barriers: Limit Royalty Sharing's Effectiveness," which is the subject of today's hearing.

For today's hearing, you asked us to comment on the S. 1537 provisions to reward laboratory inventors with royalty payments from invention income, and to limit the use of the income for the payment of expenses incidental to the administration and licensing of inventions.

In summary, Mr. Chairman, we, too, are going to be positive for the provisions in your bill, in that we support the provisions that increase the up-front royalty payments to inventors and that place a limitation on the amount of remaining income used for nonscientific purposes.

We believe that these provisions in your bill clearly address our earlier reports and findings and recommendations. The provisions, no doubt, should stimulate Federal scientists' interest in reporting future inventions and, most importantly perhaps, motivate the laboratory directors to encourage greater technology transfer than is currently occurring.

You also asked us to comment on the issue of assigning title to intellectual property to the CRADA collaborators. Because this particular report did not address this issue, we are a little uncertain at this point in terms of what impact this change would have on the overall CRADA process. However, it is a fact, and industry rep-

resentatives have confirmed with us, that having ownership and control over technology is important in developing new products.

If I could quickly just summarize and turn to some specifics of what we found when we performed our audit. Overall, the existing royalty-sharing programs, as you mentioned in your opening statement, have had little observable impact on increasing scientific interest in patenting since 1986. At most of the agencies that we evaluated and statistics that we generated from 21 Federal agencies, the rate of reporting inventions showed no real improvement after the act established royalty sharing. The numbers, quite frankly, did not look that good.

During the period of 1987 through 1991, fewer than 2 out of each 1,000 scientists received royalties. Of the roughly 170,000 Federal scientists that are out there, 2,800 reported inventions in hopes of receiving a patent. From those hopeful scientists, only 300 inventors benefited through royalty sharing.

Senator ROCKEFELLER. That is extraordinary. That is just massive.

Mr. WELLS. That is what the numbers show.

Senator ROCKEFELLER. I mean it is just massive discouragement.

Mr. WELLS. Among the reasons for this lack of success, according to the Federal scientists whom we talked with, was that the small financial rewards offer little incentive for scientists to really seek patents. For example, after payroll deductions, inventors often only received a few hundred dollars annually for each licensed invention. One inventor said that all he could do with his annual royalty payment is to treat his colleagues to pizza.

We saw an example, quite frankly, where the annual royalty check received was for $8.34. Some inventors did say that receiving royalties of more than a nominal sum would in fact motivate them to disclose and patent inventions, and it would also symbolically recognize the positive value that the inventors ascribe to their own inventions.

We therefore recommended agencies increase the up-front payments that their inventors receive. We believe the royalty-sharing provision would be more of an incentive if more inventors were not disappointed in the rewards that they were receiving. S. 1537, your bill, addresses this goal by paying to the inventors the sum of the first $10,000 in royalty, a substantial increase.

The FTTA also intended that the benefits from royalty sharing would extend beyond the inventors at the laboratory level to other scientists in their laboratories as well. However, we found that the laboratory's share of invention income had generally not been used in the manner that is visible at the laboratory level.

For example, 5 of the 13 agencies that received invention income had used or held almost 100 percent of this income to cover patenting, licensing, and other routine administrative costs related to technology transfer rather than in ways, at the local laboratory level, that were more visible to the scientist.

We believe that placing a limit such as S. 1537's 15-percent maximum on the amount of invention income that agencies can use for administrative-type expenses will in fact extend the benefits from technology transfer and, in turn, we believe, as you do, Mr. Chair-

man, that will motivate laboratory directors and others to support invention reporting and technology transfer activities.

Concerning the question of whether title to intellectual property could be assigned or should be assigned to the collaborating party in exchange for reasonable compensation to the laboratory, as S. 1537 proposes, we are uncertain what impact this provision would have on the CRADA process Governmentwide at this time.

The FTTA gave Federal agencies a lot of flexibility and discretion during the CRADA negotiations in determining who would actually receive title to intellectual property. Because we have not fully studied this issue, we are not aware of the extent to which companies are today requesting title, or the extent to which Federal laboratories are presently giving title to or withholding title from the collaborators.

In fairness, there is always two sides to every issue. There are pros and cons, if you will. Industry representatives during our review told us that when a company has free and clear right to capitalize the intellectual property arising from collaborative efforts with Federal laboratories, it is definitely more likely that the company will undertake that tremendous expense of bringing that kind of a technology at its early stage to the marketplace.

They also said that because many R&D collaborators at Federal laboratories are involved in very generic and early development of technologies, future potential applications may not be known at the time that the CRADA's are begun.

On the one hand, companies do not want to further preclude options for their commercial use of the technology. On the other hand, laboratory officials noted to us that if a company takes title to the intellectual property, the underlying technology may not be fully utilized, because, for example, the company may adapt that technology only to its own product lines, or potential applications to other fields of use may go unexplored and undeveloped, and I know you have a provision in your bill for march-in rights which may address some of those concerns.

On a related issue, some agency officials also pointed out to us that assigning title to intellectual property to the collaborator in exchange for reasonable compensation may in fact not speed up CRADA negotiation timeframes.

In practice, the time now taken to negotiate who holds the title may simply be replaced by the time taken to negotiate the amount of compensation that can be agreed to that is reasonable. In some earlier work we were doing in CRADA development, particularly in the Department of Energy, it was not unusual to see some of those negotiations taking up to 2 years.

Since we have not fully studied the issue, I guess at this point it would be fair to say it is less clear what that impact would be in assigning title for intellectual property to the collaborators, and perhaps the panel members here at the table today from private industry could share their views, being closer to that particular issue.

Mr. Chairman, in conclusion, we believe that your amendments that propose to give Federal inventors a substantial up-front portion of the income received by the agency or the laboratory, and limiting the amount of invention income that can be used for ad-

ministrative purposes, are very important steps to encourage technology transfer from Federal labs.

This concludes my statement. I will be glad to answer questions at the completion of the panel.

[The prepared statement of Mr. Wells follows:]

PREPARED STATEMENT OF JIM WELLS

We are pleased to be here to discuss the results of our December 1992 report, "Technology Transfer: Barriers Limit Royalty Sharing's Effectiveness" (GAO/RCED-93-6) as they relate to Senate Bill 1537, the Technology Commercialization Act of 1993, which would amend the Stevenson-Wydler Technology Innovation Act of 1980. As you know, the Federal Technology Transfer Act (FTTA) of 1986 amended this act by among other things establishing royalty sharing. Royalty sharing is intended to provide an incentive for scientists and government-employee inventors at over 700 federal laboratories to report, develop, and help license inventions with commercial potential. The 1986 act also established Cooperative Research and Development Agreements (CRADAs) to encourage U.S. industry and federal laboratories to collaborate on research and development of mutual interest and to license commercially-useful inventions.

For today's hearing, you asked us to comment on S. 1537's provisions to (1) reward laboratory inventors with substantial up-front royalty payments from invention income, (2) place some limitation on the amount of the remaining income that is used for "payment of expenses incidental to the administration and licensing of intellectual property," and (3) assign title to intellectual property arising from a CRADA to the collaborators in exchange for reasonable compensation to the laboratory. In addition, we would like to discuss certain procedural impediments to patenting inventions noted in our report, which may continue to limit the effectiveness of incentives for technology transfer at some federal laboratories.

In summary, Mr. Chairman, we support the bill's provisions to increase the up-front royalty payments to inventors and place a limitation on the amount of remaining income used for nonscientific purposes. We believe that these provisions clearly address our report's findings and recommendations and should stimulate federal scientists' interest in reporting inventions, and motivate laboratory directors to encourage technology transfer. Regarding the issue of assigning title to intellectual property to CRADA collaborators, because our report did not address this issue, we are uncertain what impact this change would have on the overall CRADA process. However, industry representatives told us that having ownership and control over technology is important in developing new products. In addition, there are certain procedural impediments, such as the lack of ready access to advice on patenting inventions or the slow and arbitrary nature of selecting inventions to patent, that continue to be a detriment to incentives for technology transfer at federal laboratories.

BACKGROUND

Prior to the enactment of FTTA, federal law generally required that royalty income, received under agency agreements that licensed patents, had to be turned over to the U.S. Treasury and could not be retained by the agency. However, the Department of Commerce's National Technical Information Service, which licenses inventions for many agencies, had previously initiated a small awards program that typically paid the inventor the greater of $300 or 15 percent of the invention income each year, generally up to a maximum of $10,000.

FTTA expanded this initial royalty-sharing program. Recognizing the diverse nature of the over 700 federal laboratories, the Congress authorized each agency to select its own formula for allocating invention income between the inventor and the laboratory as long as the inventor (or co-inventors), during any one fiscal year, received at least 15 percent of the invention income up to $100,000 for each inventor. The act also requires that the balance of invention income go back to the laboratories—with the majority share going to the laboratory where the invention occurred—for payment of expenses incidental to the administration and licensing of inventions; rewards for laboratory employees; scientific exchange among agency laboratories; or education and training consistent with the R&D mission, and for other activities that increase the licensing potential of technology.

Typically, a federal inventor must first report an invention by requesting and completing a document known as an invention disclosure. Submission of this document usually marks the first time the agency's management is made aware of a scientist's interest in patenting. Then, technical reviews are conducted, patent records are searched to identify any previous patents for the invention, and an application

is filed with the U.S. Patent and Trademark Office. Finally, the agency is free to license the patent for the invention to one or more companies.

The entire technology transfer process—from research to royalties—normally takes many years from beginning to end and can come to an abrupt halt at any number of places along the way. Some research can yield inventions, some inventions can be patented, and some patents can, in turn, be licensed. However, royalties cannot be shared unless (1) the inventor reports the invention on an invention disclosure, (2) the federal agency is able to license the patent or patent application to a company, (3) a customer buys the product from the company, and (4) the company or licensee annually returns royalties, at the agreed rate, to the licensing federal agency.

INCREASING SCIENTISTS' INTEREST IN PATENTING

Overall, we found that the existing royalty-sharing programs have had little observable impact on increasing scientists' interest in patenting. At 14 of the 21 agencies we evaluated, the rate of reporting inventions showed no real improvement after the act established royalty sharing. Real improvement in reporting rates at six of the seven other agencies could be attributed to the effects of scientific or legal activities, or other legislation on patenting that preceded or coincided with FTTA rather than to the implementation of royalty sharing.

Among the reasons for this lack of success, according to the federal scientists whom we talked with, was that small financial rewards, such as those paid under some royalty-sharing programs, offer little incentive for the scientists to seek patents. For example, after payroll deductions, inventors often received only a few hundred dollars annually for each licensed invention. We found (1) the royalty-sharing formulas selected by 17 of the 21 agencies often limit royalties that inventors can receive, (2) the total income from most inventions falls below $10,000 annually, and (3) more than one inventor is typically responsible for an invention.

In addition, we found that many inventors held little expectation that their inventions would be licensed or commercially successful enough to produce royalties. Nevertheless, some inventors did say that receiving royalties of more than nominal sums would motivate them to disclose and patent inventions and would symbolically recognize the positive value that inventors ascribed to their own inventions. Thus, in our December 1992 report, we recommended that agencies employ a threshold-style royalty-sharing formula that would increase the up-front payments that their inventors receive. We believe that royalty sharing would be a more effective incentive if fewer inventors were disappointed in the rewards they receive. S. 1537 would implement our recommendation by paying to the inventor(s) the sum of the first $10,000 in royalties and 15 percent of any additional royalty income less certain R&D laboratory expenses.

MOTIVATING LABORATORY DIRECTORS TO ENCOURAGE INVENTION REPORTING

FTTA also intended that the benefits from royalty sharing would extend beyond the inventor(s) to other scientists at the laboratories as well. However, we found that the laboratory's share of invention income has generally not been used in a manner that is visible or tangibly benefits potential inventors. For example, between 1987 and 1990, 5 of the 13 agencies that received invention income had used, or held, almost 100 percent of this income to cover patenting, licensing, and other routine administrative costs related to technology transfer, rather than in ways more visible to laboratory scientists. In the most notable case, NIH used 80 percent, or $20.1 million of its AIDS test kit income, to settle an invention ownership dispute on the basis that such expenses could be considered "incidental to the administration and licensing of inventions" under the FTTA. Although the AIDs test kit case is the largest single example of the use of invention income to pay for administrative-type expenses, similar uses for such income at other agencies have left their laboratory directors with little or no visible benefits from royalty sharing.

Agency officials acknowledged that laboratory directors are less likely to encourage invention reporting when the cost of patenting increasingly consumes funds that could be used to enhance research activities at their laboratories. Decisions to spend all of the laboratory's share of invention income for "things outside of research," one laboratory director said, were "just not right." Another director said that he did not want to see an increase in the number of scientists requesting patents as long as the cost of processing patents was subtracted from his laboratory's research budget and he saw no direct benefit from the laboratory's share of the royalties.

To ensure that the agencies share invention income with the laboratories in a manner that creates visible and tangible benefits to potential inventors, our report suggested that the Congress consider more specifically defining "expenses incidental

to the administration and licensing of inventions." We believe that placing a limit, such as S. 1537's 15-percent maximum, on the amount of invention income that agencies can use for administrative-type expenses will extend the benefits from technology transfer and, in turn, motivate laboratory directors and others to support invention reporting and technology transfer activities.

ASSIGNING TITLE TO INTELLECTUAL PROPERTY

Concerning the question of whether title to intellectual property should be assigned to the collaborating party in exchange for reasonable compensation to the laboratory, as S. 1537 proposes, we are uncertain what impact this provision would have on the CRADA process, government-wide at this time. The FTTA gave federal agencies considerable flexibility and discretion during CRADA negotiations in determining who should receive title to intellectual property. Because we have not fully studied this issue, we are not aware of the extent to which companies are requesting title, or the extent to which federal laboratories are presently giving title to, or withholding title from, their collaborators.

Industry representatives told us, however, that when a company has "free and clear right to capitalize on the intellectual property" arising from collaborative efforts with federal laboratories, it is more likely to undertake the expenses of bringing technology to the marketplace. They also said that because many R&D collaborations at federal laboratories are involved with generic, or early development of, technologies, future potential applications may not be known when the CRADA is finalized. On the one hand, companies do not want to preclude future options for their commercial use of the technology. On the other hand, laboratory officials noted that if a company takes title to the intellectual property, the underlying technology may not be fully utilized because, for example, the company may adapt that technology only to its own product lines while potential applications to other fields of use may go unexplored and undeveloped.

Some agency officials pointed out that assigning title to intellectual property to the collaborator in exchange for reasonable compensation, may not speed up CRADA negotiations time-frames. In practice, the time taken now to negotiate who holds the title may simply be replaced by the time taken to negotiate the amount of compensation that is considered reasonable.

DEALING WITH OTHER PROCEDURAL IMPEDIMENTS

Finally, as we noted in our report, agencies have done little to remove various existing procedural impediments to an inventor's pursuit of a patent. Although S. 1537 does not address these impediments, we remain concerned about them. For example, many scientists said they had little training or ready access to advice and information about what constitutes patentable subject matter and how to determine the commercial desirability of their inventions. Scientists said that now, compared with 15 or 20 years ago, fewer patent advisers are available to visit them in their laboratories and assess the patentability of their on-going research. One scientist said that researchers at his laboratory had no personal contact with patent advisers. Another scientist said that getting a patent requires the support of someone who is available to "walk you through the process."

Many scientists also voiced many complaints about how slow, arbitrary, and sometimes biased their agencies were in selecting inventions to patent. Although some agencies have established standing committees that meet regularly to evaluate inventions to be patented, other agencies have ad hoc groups of technical personnel that meet irregularly. One scientist characterized his agency as a "Never Never Land" because it took so long to respond to his invention disclosure. He added, "If you [the inventor] are real aggressive, you can get it to the patent office in a year and a half. * * * It's outrageous."

To deal with these concerns, our report recommended, among other things, that heads of agencies (1) provide more information and training for laboratory scientists on the kind of subject matter that is patentable and on the approach that is appropriate for evaluating an invention's commercial demand, and (2) establish procedures for the timely and consistent selection of inventions for patenting.

CONCLUSIONS

Mr. Chairman, we believe the amendments being proposed to (1) give federal inventors a substantial up-front portion of the income received by the agency or laboratory for the intellectual property and (2) limit the amount of invention income that can be used for "expenses incidental to the administration and licensing of inventions" are very important steps to further encourage technology transfer at federal laboratories. However, since we have not fully studied the issue, it is less clear

to us what the impact would be of assigning title for intellectual property to the collaborator. We remain concerned that agencies are still not adequately addressing certain other procedural impediments to royalty sharing at the laboratories identified in our December 1992 report. If these agency impediments are not addressed by management, any future evaluations of incentives, such as royalty sharing, may show a similar lack of real impact regardless of what other changes are made to the law.

Mr. Chairman, this concludes my statement. I would be happy to respond to any questions you or the members of the Subcommittee may have.

["Technology Transfer: Barriers Limit Royalty Sharing's Effectiveness," by GAO may be found in the committee's files.]

Senator ROCKEFELLER. We will do that when we finish with the panel, but I just need to say loudly and clearly that we could not have done this without the help that you have given us. You have been really, absolutely terrific on it, and I am grateful to you and all the people that helped you.

Mr. WELLS. Thank you for those kind remarks.

Senator ROCKEFELLER. Dr. MacLachlan, your name must be misspelled as much as mine is. I am very anxious to hear your testimony.

STATEMENT OF DR. ALEXANDER MacLACHLAN, SENIOR VICE PRESIDENT, DUPONT CO.

Dr. MACLACHLAN. I also get middle initials added. People do not like to believe you do not have a middle initial.

Senator Rockefeller, distinguished members of the subcommittee, my name is Al MacLachlan. I am senior vice president for research and development at the DuPont Co. We are the Nation's largest and oldest of what are known as diversified chemical companies, and it is the diversified large companies in the chemical industry that do most of the research for new materials.

We manufacture and largely invented one of the world's largest portfolios of advanced materials, including specialty chemicals fibers, ceramics, polymers, composites, and even products based on biotechnology. In addition, we are a major supplier of crop protection chemicals, specialized materials that are critical for the electronics industry and photographic films, and products for the health and commercial printing industries.

I am responsible for directing annual research and development expenditures of about $1,300,000,000, and over my career of 36 years plus now I have become intimately familiar with the risks, rewards, and time associated with bringing in new products and processes and new businesses to the marketplace.

DuPont employs 125,000 people worldwide, and has 90,000 here in the United States. Our thousands of products, literally thousands of products feed and enable all the large systems integrators such as aerospace construction, automotive, electronics, and defense, and of course the millions they employ. We provide and often innovate the building blocks for growth, jobs, and quality of life.

As a whole, the chemical industry is one of our country's most successful industries, and has been for decades. It employs, over 1 million people, and positively contributes more than $18 billion to our international balance of payments.

Mr. Chairman, I am here today to speak in support of S. 1537, which would amend the Stevenson-Wydler Technology Innovation Act of 1980, and I would like to compliment you and your committee, on your leadership in this area and also in the area of product liability reform, both of which are essential components to make America competitive in the world marketplace.

Through my testimony today, I would like to help establish that this will encourage more extensive participation of companies like DuPont in cooperative research and development agreements and speed the commercialization of the U.S. advanced technologies.

In my 36 years with DuPont, most of it in research, I have never experienced a business environment quite like the one we have today. While our R&D capabilities are second to none in the world, U.S. industry faces enormous technology and financial challenges to stay ahead of highly capable global competitors, to improve the quality of the products and services that we have, and to operate in an environmentally acceptable manner.

At DuPont, I am confident we will meet the challenges on product and process innovation. We invested more than $4.5 billion in capital projects last year, of which more than $1.3 billion went into efforts to improve our environmental performance.

With R&D costs rising, and with competitive pressure squeezing profitability, we have been looking for collaborative efforts to better leverage our resources and substantive partnerships with Government laboratories through CRADA's could be a major source of such leverage, but the establishment of a CRADA is, as we have been hearing here, and also from our point of view, often difficult.

In many cases, it has taken well over a year to negotiate a successful CRADA, and because current law gives Government laboratories an option to claim ownership to technology developed jointly by a laboratory and a private research partner, we have restricted ourselves more or less to generic technologies.

At last count, DuPont had 16 active CRADA's and about 12 under negotiation with various national and Federal laboratories. By generic technology partnerships, I mean our activities have been limited to fundamental research, precompetitive, if you will, utilization of sophisticated computing facilities, molecular and process modeling, and advanced analytical equipment.

This is extremely important and is the reason why we have so many CRADA's, but I would also like to see us working as well in core areas that aim to make chemicals and new products in new and more efficient ways. But such research would require a larger commitment from the Government laboratories and significantly larger resources from DuPont. Intellectual property rights immediately become an issue. We simply cannot make the required investment without some assurance that we will have freer commercialization rights in any resulting technology developments.

Let me give you a couple of examples.

Senator ROCKEFELLER. Are you satisfied that under this bill you would have full such use?

Dr. MACLACHLAN. I believe so. Clearly, as the gentlemen on my right indicated, it is going to be a negotiation process, and probably will take quite a long time, but at least we know we are going to

end up with something substantive, and with time it should shorten. That is the way I look at it.

A couple of examples. We have been working through individual secrecy agreements with both Sandia and Los Alamos Laboratories for some time now on diamond-deposited materials and the process development steps. We wanted to pool resources through a CRADA but we became bogged down in negotiations over who would own the intellectual property rights of the resulting products. We lost at least 6 months of research time and ended up settling for nonexclusive rights with the right to negotiate for exclusive rights at a later date.

Additionally, because of current practices, we had to have separate preexisting secrecy agreements in addition to the CRADA, and some Government lab employees are constrained as to how they can do their jobs. Now, we are trying to resolve this, but if intellectual property rights were more clearly available to us, we could afford to take more risk as the research proceeded.

Senator ROCKEFELLER. But is not part of the lesson of your statement also—and I apologize to my colleague for interrupting, as I do to you, sir—that in spite of all of these difficulties, in spite of the hassles, in spite of the certainty of not being able to get the level of ownership, et cetera, out of this that you want, you still are going ahead, plowing ahead, trying to get the best you can? That is an extraordinary statement.

Dr. MACLACHLAN. Absolutely, and in this case it is such early stage technology, and technology that we are so uncertain about what it will do, and at the same time seems to have a lot of promise. It is worth the risk. This is the way we look at it.

Senator ROCKEFELLER. Worth the risk, even though under present law you do not walk out of there with anything exclusive at all?

Dr. MACLACHLAN. That is correct. Now, we are operating on the faith that we will be able to do that, and of course we can make decisions at any time relative to when it is time to part and focus on the real commercialization.

In the second case, we were asked by a Government lab to be a partner in a CRADA to work in high-temperature superconductivity. "High-temperature superconductivity" has been defined as a critical technology for the United States. It is also intensely competitive internationally.

The most definitive market forecast for superconductivity was jointly produced by a group of corporations and organizations from the United States, Japan, and Europe earlier this year in a meeting in Japan. It projected a $200 billion market opportunity by 2020, growing up from about $10 billion in the year 2000.

Now, whether you believe these large numbers or not, they are still very large, and this translates into hundreds of thousands of jobs if the United States is competitive. In attempting to negotiate a CRADA with one of the national laboratories, we were unable, after 6 months of negotiation, to reach an agreement on proprietary rights or to protect extensions of DuPont technology that we would transfer to the national laboratories from being freely transmitted to our competitors. In that case, we did not finish the CRADA.

In yet another instance, 10 partners, a consortium of 4 Government labs and 6 private companies, wanted to conduct research on biotechnical routes to organic molecules. Because of the intellectual property rights issue, the CRADA research has different targets than it would if S. 1537 had been in place. In other words, we are not going for the key ingredient. We are studying the basics of making it.

Research conducted in a CRADA is, of course, of interest to both partners, and through the provisions of S. 1537 the Federal Government would retain a paid-up, irrevocable license for its own use of the intellectual property. The proposed bill would retain future compensation from the private sector partner and also direct compensation to the laboratory scientists who make the discovery.

In my view, the proven track record of commercialization of university-developed technology under the provisions of the Bayh-Dole act of 1980 offers another compelling reason to amend the existing law. The proposed legislation would encourage the commercialization of Government lab-developed technology by industry by clearly addressing the intellectual property rights issue.

The proposed legislation also complements the Department of Energy's proposed new technology transfer strategy for its large network of laboratories and facilities which should cut CRADA processing time by one-half and delegate small CRADA authority to the directors of the Department's contractor-owned laboratories.

Before closing, I would like to explain briefly why the assignment of intellectual property rights is so important to capital-intensive industries like ours, the same answer, basically, that Dr. Good gave.

In the chemical industry, once research yields a new idea and a decision is made to move forward toward commercialization, costs soar. Development costs typically run 10 to 20 times the cost of the research, and building a manufacturing plant can run into tens, if not hundreds of millions of dollars, and require 5 to 10 years of sustained effort.

Obviously, we cannot commit dollars and resources needed to commercialize new technology without being certain our chances of recovering our investment are reasonable. Historically, we have needed to rely on good patents and ownership of intellectual property right to do this.

In conclusion, I believe the changes proposed in S. 1537 will result in both better use of Government laboratories, and increased commercialization of CRADA-discovered technology. The need is urgent, and our international competitiveness is at stake, and I thank you very much.

[The prepared statement of Dr. MacLachlan follows:]

PREPARED STATEMENT OF DR. ALEXANDER MACLACHLAN

Senator Rockefeller, Distinguished Members of the Subcommittee, my name is Al MacLachlan. I am Senior Vice President for Research & Development at the DuPont Company. We are the nation's largest and oldest of what are known as diversified chemical companies. It is the diversified, large companies in the chemical industry that do most of the research for new materials. At DuPont, our exploration into materials science has allowed us to literally invent our way into most of the businesses DuPont is in today. We manufacture one of the world's largest portfolios of advanced materials including specialty chemicals, fibers, polymers, ceramics, composites and biotechnology products. In addition, we are a major supplier of crop protection

chemicals, materials critical for the electronics industry, and photographic films and products for the health and commercial printing industries.

I am responsible for directing annual research and development expenditures of about $1.3 billion. This is directed to the search for new knowledge that can serve as the basis for renewal of existing businesses and the building of wholly new ones. In more than 36 years with DuPont, I have worked in all facets of this effort. I am intimately familiar with the risks, rewards and time associated with bringing new products, processes and new businesses to the marketplace.

DuPont employs 125,000 people worldwide and has 90,000 here in the United States. We like others in the chemical industry work at the front end of the "food chain" for manufacturing. Our products feed and enable all the large system integrators such as aerospace, construction, automotive, electronics and defense—and the millions they employ. We provide—and often innovate—the building blocks for growth, jobs and quality of life.

As a whole, the chemical industry is one of our country's most successful industries. It employs more than 1 million people and positively contributes more than $18 billion to our international balance of payments. The chemical industry has always been a capital intensive industry, both in R&D and plant construction, and the key to our sustained ability to compete is our ability to invent new products and processes that improve costs, quality and environmental performance.

Mr. Chairman, I am here today to speak in support of S. 1537, which would amend the Stevenson-Wydler Technology innovation Act of 1980. I would like to compliment you on your leadership in this area, which is so critical to our country's international competitiveness, and is the same kind of leadership that you have demonstrated on product liability reform, another essential component in making America competitive in the world marketplace.

KEY POINTS

Through my testimony today, I would like to establish that this bill would encourage more extensive participation of companies like DuPont in Cooperative Research and Development Agreements, commonly called CRADAs, and speed the commercialization of U.S. advanced technologies keys to both our country's international competitiveness and the creation of new, high quality jobs here at home.

DISCUSSION

In my 36 years with DuPont—most of it in research—I have never experienced a business environment quite like the one we have today. While our R&D capabilities are second to none in the world, U.S. industry faces enormous technology and financial challenges to stay ahead of highly capable global competitors, to improve the quality of our products and services, and to operate in an environmentally acceptable manner.

At DuPont, I'm confident that we will meet these challenges in product and process innovation. About 20 percent of the products we sell today were developed or improved significantly in the last five years, and we have major process breakthroughs under development today in every major business area. We invested more than $4.5 billion in capital projects last year of which more than $1.3 billion went into efforts to improve our environmental performance. This included R&D to develop processes that don't create waste from the outset.

With R&D costs rising and worldwide competitive pressure squeezing profitability, we have been looking for collaborative efforts to better leverage our resources. Substantive partnerships with government laboratories through CRADAs could be a major source of such leverage. But the establishment of a CRADA is, from our point of view, often difficult. In many cases it has taken well over a year to negotiate a successful CRADA. And because the current law gives government laboratories an option to claim ownership to technology developed jointly by a laboratory and a private research partner, we have restricted ourselves to generic technologies. There is no incentive to do anything other than general research. There is no question that complications over intellectual property rights are often the main sticking point during CRADA negotiations.

At last count, DuPont had at least 16 active CRADAs and at least 12 under negotiation with various national and federal laboratories. By generic technology partnerships, I mean our activities have been limited to fundamental research, utilization of sophisticated computers, molecular and process modeling and advanced analytical equipment. I would like to see us working as well in core areas that aim to make chemicals and new products in new and more efficient ways. But such research would require a larger commitment from the government laboratories and significantly larger resources from DuPont. Intellectual property rights immediately

become a issue. We simply cannot make the required investment without some assurance that we will have freer commercialization rights in any resulting technology developments.

Let me give you a few examples of our experience to date with the CRADAs we have.

• We've been working through individual secrecy agreements with both Sandia and Los Alamos laboratories for some time now on diamond coated materials and the process development steps. We wanted to pool resources through a CRADA, but we became bogged down in negotiations over who would own the intellectual property rights of the resulting products. We lost six months of research time and ended up settling for non-exclusive rights with the right to negotiate for exclusive rights at a later date. Additionally, because of current practices, we need to have separate, pre-existing secrecy agreements in addition to the CRADA, and some government lab employees are constrained as to how they can do their jobs. We are trying to resolve this, but if intellectual property rights were more clearly available to us we could afford to take more risk as the research proceeds.

• In another case, we were asked by a government lab to be a partner in a CRADA to work on high temperature superconductivity. High temperature superconductivity has been defined as a critical technology for the U.S. It is also intensely competitive internationally. The most definitive market forecast for superconductivity was jointly produced by many corporations and organizations from the U.S., Japan and Europe earlier this year. It projects a $200 billion market opportunity by 2020, growing from $10 billion in the year 2000. This translates into hundreds of thousands of jobs if the U.S. is competitive. In attempting to negotiate a CRADA with one of the national laboratories we were unable, after six months of negotiation, to reach an agreement on proprietary rights or to protect extensions of DuPont technology that we would transfer to the national laboratories from being freely transmitted to our competitors.

• In yet another instance 10 partners—a consortium of four government labs and six private companies—wanted to conduct research on biotechnical routes to organic molecules. Because of the intellectual property rights issue, the CRADA research has different targets than it would if S. 1537 had been in place.

Research conducted in CRADAs is, of course, of interest to both partners and through the provisions in S. 1537 the federal government would retain a paid-up, irrevocable license for its own use of the intellectual property. The proposed bill would retain future compensation from the private sector partner and also direct that compensation to the laboratory scientist who made the discovery.

In my view, the proven track record of commercialization of university-developed technology under the provisions of the Bayh-Dole Act of 1980 offers another compelling reason to amend the existing law. The proposed legislation would encourage the commercialization of government lab-developed technology by industry by clearly addressing the intellectual property rights issue. The proposed legislation also compliments the Department of Energy's proposed new technology transfer strategy for its large network of laboratories and facilities, which should cut CRADA processing time by half and delegate small CRADA authority to the directors of the department's contractor-owned laboratories.

Before closing, I'd like to explain briefly why the assignment of intellectual property rights is so important to capital intensive industries like ours. In the chemical industry, once research yields a new idea and a decision is made to move forward toward commercialization, costs soar. Development costs typically run 10 to 20 times the cost of the research, and building the manufacturing plant can run into tens if not hundreds of millions of dollars, and require five to ten years of sustained effort. Obviously, we cannot commit the dollars and resources needed to commercialize new technology without being certain of our chances of recovering our investment. Historically we have needed to rely on good patents and ownership of intellectual property right to do this.

In conclusion, I believe the changes proposed in S. 1537 will result in both better use of government laboratories and increased commercialization of CRADA-discovered technology. The need is urgent. Our international competitiveness is at stake. Thank you for the opportunity to share my views.

Senator ROCKEFELLER. Thank you, Dr. MacLachlan. You know, I have got to say, I am sitting here very impressed. I mean, here is the biggest, as far as I am concerned, the biggest chemical company. You certainly are in West Virginia. You have been at this, you said, for 36 years. All that time has been in research.

Dr. MACLACHLAN. Almost all. I have been in business for about 7 years. I have run businesses.

Senator ROCKEFELLER. Well, we will reduce it to 30 years, then. That is a long time, and you are in the private sector. My guess is you do not wake up every morning thinking about, gee, I wonder what the Federal Government is going to do for me today? It is probably what the Federal Government is going to do to me today, and you are saying, this is a good deal. This bill would make us in the private sector more aggressive.

I am commercializing. I should not do that. Mr. Ostfeld, you are on, sir.

STATEMENT OF DAVID OSTFELD, VICE PRESIDENT, CAREER ACTIVITIES COUNCIL, INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

Mr. OSTFELD. Let me commercialize for you, then. My name is Dave Ostfeld. I am a volunteer speaking on behalf of the 240,000 engineers and scientists who are U.S. members of the Institute of Electrical and Electronics Engineers. The last time I was here I had 2 minutes. I am going to try to limit it to 7 this time.

We are very much in favor of the bill. Frankly, it yields rewards to the laboratory scientists and engineers for CRADA's, whether they are with a GOGO or GOCO. That is new and that is terrific. It promotes CRADA's through greater assignment rights and use of compensation from CRADA's for the producing laboratories to generate more CRADA's, something that the laboratories miss now because sometimes they do not have enough funds for all the CRADA's that approach them.

Further, it protects the domestic preference explicitly by march-in rights, which at least some of the laboratories have some temerity about, but it also implicitly promotes domestic preference by reserving intellectual property rights arising solely from the efforts of laboratory personnel. Last, it permits leveraging of the private research funds making up the leverage of successful operations at the back end.

Thus I feel sort of like an appellant's counsel who has just watched an appellee suffer a devastating examination by the appellate court and just wants to sit down and say, "You gentlemen have this matter well in hand; I do not want to say anything more to disturb you."

But—my wife always says "but" means you are erasing all the nice things you said ahead of time, but I really do not mean that. I really mean the laudatory things I have said of this well-crafted bill of Senator Rockefeller who at one time was my representative when he and I were both significantly younger and I lived in Charleston, WV, where I was, at that time, an engineer with Union Carbide Corp. And I am an inventor and I am now a lawyer in private practice representing, not DuPont certainly, but other companies that deal in licensing, including the Federal laboratories.

Senator ROCKEFELLER. And you survived being represented by me which I think is a deep tribute to you.

Mr. OSTFELD. And the Charleston Light Opera Guild too, I survived that.

Anyhow, even if what we are about to suggest were not achieved, we still would be in favor of the bill very strongly. We have a lot of enthusiasm about this bill. We would suggest some things that you might want to consider with regard to the bill.

First, you might want to specifically designate that in the regulations the laboratory director should have the final say over the compensation issue. In doing that, I think you would shortcut under your new bill a lot of the time that is speculated now may be taken in negotiating CRADA's.

Senator ROCKEFELLER. Can you explain for Senator Burns and I why that would accelerate the process?

Mr. OSTFELD. Well, if I understand correctly, the view of this bill is that there is a lot of valuable Federal technology and part of our problem is being able to present it, package it properly so that industry says, "Yes, that is something I really want, and we can get closer to commercialization on a much faster time basis." What you are assuming is we are going to have much larger compensation packages. It would be better if the laboratory directors held their own destiny, did their own negotiating on their CRADA's, rather than having it go back and forth up the line, as it sometimes does, in today's negotiating marketplace.

Senator ROCKEFELLER. OK.

Mr. OSTFELD. And I have spoken to a couple of licensing people at the labs who say, "Yes, that would be a good idea." Obviously, they want to remain anonymous.

No. 2, I would specifically state, in the portion of section 14 that you are going to amend of the Stevenson-Wydler Act, dealing with use of income, that basic and applied research should share approximately equally in the compensation that will be put back into the laboratory, to recognize that while basic research may be slower yielding reward, it certainly is no less a priority.

Third, we would suggest specifically providing incentives, beyond an expanded budget, to the operators of GOCO's to file more patent applications, to encourage them to buy into the new program. The program looks like it has great rewards promised theoretically, and I think practically you are going to motivate the engineers and scientists in those labs to want to do things.

We have heard about how few inventions actually ripen and what engineers and scientists sometimes think about the ripening of these incomes from inventions. It would be nice to cause the GOCO's, who are the especial problem, I think, in filing, more than GOGO's are, to feel a need to want to file patent applications; to encourage their staffs to disclose and to push, to fight for applications; to encourage entrepreneurial skills for those who like applied research. It is never usually one person: it is a group that wants to get something done that does achieve the ultimate result and produce things, technologies, that are desirable for the private industry.

Senator ROCKEFELLER. Can I just ask on that—and I beg my colleague's forgiveness on this—there has to be out there at Sandia Labs and other places all of these superb Federal researchers. They know or suspect or are told that the cold war is ended. They know that there is this thing called downsizing. They are scared. Regardless of all of those things, they are brilliantly trained and they have

brilliantly applied themselves to tasks which they have been asked to do.

Would it not be a matter of human nature, plus self-survival, that they now, more than at any other time, would be thinking in their spare time of what it is they could do that would be made commercially successful? I mean would they not naturally be inclined that way right now, knowing that what they have been doing is probably not going to be asked of them as much?

Mr. OSTFELD. Let me emphasize even more the concern in your question—one of my clients related to me that an engineer came to him and asked him if he could be a machinist trainee at my client's company, because at that time he was working at a fast-food chain and anything was better than that. My son also attested to that fact when he worked at a fast-food chain.

But the answer to your question is "Yes"; they should be thinking of commercialization, and I think what is happening can be illustrated by taking Sandia as a mythical example of a laboratory that may live in New Mexico somewhere. If you as a potential entrepreneur are stopped, if no one cares at the level above you for the innovative ideas that you produce, and if you cannot induce someone at the administrative level to patent those things for you, nor can you obtain clearance to take them and separately produce your own innovation out of it, eventually you become discouraged because it is a dead-end street.

I agree with you. I think that those people are motivated. I think they do want to improve. I think that the encouragement that this bill gives to the laboratories to aid its own scientists is a definite positive step. And that is why I was suggesting we might even want to push it a little further and say to the operators of the labs, "Look, let me show you some extra incentive besides a growing budget for you to administer, so that you will get on the bandwagon, so that you will begin to listen to your people as they bubble up ideas to you."

[The prepared statement of Mr. Ostfeld follows:]

PREPARED STATEMENT OF DAVID M. OSTFELD

I am pleased to testify on behalf of the Institute of Electrical and Electronics Engineers-United States Activities' (IEEE-USA) Intellectual Property Committee. The Committee represents the considered judgment of a group of U.S. IEEE members with expertise in the subject field. The IEEE United States Activities Board promotes the career and technology policy interests of the 240,000 electrical, electronics, and computer engineers who are U.S. members of IEEE.

Our U.S. members believe that the "Stevenson-Wydler Technology Innovation Act of 1980" and the "Federal Technology Transfer Act of 1986" have played an important role in stimulating and increasing the quality of technology in the United States. These acts have permitted the U.S. to enter into cooperative research and development agreements (CRADA) with the private sector. CRADAs have become the typical mechanism for the U.S. private sector to obtain "sensitive" or unpublished information from the U.S. national laboratories. CRADAs also allow the private sector to have access to U.S. engineers, scientists, and facilities at the national laboratories. This results in additional U.S. jobs, domestic research and development, and improved U.S. competitiveness.

However, under present law, government agencies working on research and development in cooperation with private industry may retain intellectual property rights which make CRADAs less attractive to industry. The "Technology Commercialization Act of 1993" (S. 1537) would require Federal agencies to assign, to the private sector, intellectual property rights which are created or invented in part by employees of the United States government or employees of the laboratory operators while working under CRADA.

Thus, IEEE-USA strongly supports this bill. We do, however, have some suggestions and comments, but based on the premise that we strongly support this bill and would support it even if no changes were made. We feel that the following suggestions would enhance the bill and further its goals and objectives.

First, we noted in Senator Rockefeller's floor remarks that title would be provided on the basis of "reasonable compensation" without further delineation. We believe this is an excellent method and will give the various Federal agencies the ability to determine for themselves how best to negotiate an agreement. Nevertheless, our members have noted that there is a fairly long lag time between the inception of interest in a CRADA and the time that the interested parties reach agreement.

Therefore, IEEE-USA believes that it is important for Federal agencies to promulgate regulations concerning income; which we understand will be done. However, we believe that the percentage of income should be left to the discretion of the laboratory directors. Without such regulations there may be further delays in closing agreements for CRADAs. Thus, we would suggest that you consider amending the bill to provide for the promulgation of such regulations with the delegation of authority to the laboratory director to negotiate the actual percentage of income.

Although the issue of basic research is not specifically addressed in S. 1537, IEEE-USA believes that it is important to include in the legislation or legislative history a specific recitation that would clarify that the objective of this bill is not to dissuade the Federal laboratories from pursuing basic research. Accordingly, such research as well as applied research might be specifically referenced as part of the other activities in Section (a)(1)(B)(iv) of the amendment to Section 14. We believe that Federal laboratories are still one of the few remaining places where basic research is done. One of the distinguishing characteristics of the United States' advantage in global competitiveness has been the application of basic research, as well as the development of the basic principles on which whole technologies are based. To lose that advantage and to permit countries to take over that function, is to lose an underlying basis for the wealth of the United States.

Certainly, some scientists and engineers in the Federal laboratories will be highly motivated by increased monetary reward, especially if they are able to receive the reward on a short term basis from applied research. As Senator Rockefeller has remarked in his floor statement, these people should be further stimulated and invited to concentrate their efforts on helping the United States maintain or regain its lead in technology.

However, there are other scientists and engineers at the Federal laboratories for whom monetary reward is not as important as the work they do in basic research. We do not want to send a message to scientists and engineers that basic research does not serve valuable national needs. While the bill may not specifically provide monetary incentives for those working in basic research under Section (a)(1)(B)(ii), their work should still be encouraged and funded which might be more specifically culled out in Section (a)(1)(B)(iv) as discussed above.

We also note that this bill is to apply to employees and inventions in GOCOs as well as GOGOs. However, it is our understanding that despite the clear intention of "The Technology Commercialization Act of 1993" to encourage patenting within the Federal laboratories, in reality the bill does not offer incentive for the company operated government laboratories to use budgeted funds for the expense of preparing and prosecuting patent applications on behalf of their employees; even though these could lead to greater budgets from compensation under the CRADA.

While there is a reward incentive for the individual engineers and scientists who are employees of the company that operates the GOCO, there is no incentive for the company to pursue such operations. Indeed, it is our understanding that just the opposite is the case. Almost no patents are filed by some GOCOs. IEEE-USA believes that for the "in whole" exception, Congress should provide economic incentives to encourage GOCOs to file for patents or register for copyrights thereby benefiting the GOCO employees as well.

More specifically, we also have some more detailed technical suggestions concerning the structure of the bill. The first of these is the exception contained in the first amendment of Section 12 of the Stevenson-Wydler Technology Innovation Act of 1980.

With regard to a CRADA, there may be some difficulty in defining the term "proprietary information" as defined in the present statute and as used in the third amendment to Section 12. Certainly if it is information supplied by the private sector company, this would be a correct term. Likewise, if it is information that is developed by the private sector company, it is also correct. However, there are some situations where "proprietary" may not be the appropriate terminology. Government developed information may not have been made public yet. This information may

form part of the basis for entering a CRADA and may need to become public under other statutes. Therefore, this situation may form a basis for criticism of the bill.

With regard to the amendment to Section 14 of the "Stevenson-Wydler Technology Act of 1980," and in particular the amendment to subsection (a)(1)(A)(i), we believe that the compensation is for each intellectual property, therefore we think it would be better to use the word "each" for the first $10,000 and the following 15 percent for payments to the Federal laboratory employees or employees of the Operator who have assigned their rights in intellectual property.

In this regard, we are not sure that regulations will automatically provide for compensation in whole to be preagreed at the inception of the CRADA and allocation among the intellectual property licensed or assigned after the CRADA once the results are available. Thus, to avoid ambiguity, it may be a good idea to amend the bill, in its current form, to point out that the 15 percent is applied proportionally to the portion of the pool or compensation allocated to the particular intellectual property for purposes of dividing the money. Further, because it is possible that GOCO employees may be paid more by the operator's current reward system, the $10,000 and the 15 percent should be separately measured against their current compensation, and the larger amount paid to them even though this may create more accounting. By doing so, the bill encourages rather than discourages the innovation.

With respect to the amendment to Section (1)(a)(i), IEEE-USA wishes to point out that the law of copyright does not permit an assignment of a copyright by an employee to the employer. This situation is perceived as a "work for hire" and thus is automatically owned by the employer. Therefore, employees of the operator of the GOCO would not receive royalties from copyrights. Accordingly, we recommend the following clarification by inserting the words: "or deemed to be owned by the employer by a statute" after the words "collaborating party or parties to a research agreement."

Further, after the words "intellectual property to the United States, to," delete "the" and insert "a" in light of the correction to subsection (a)(4) of Section 14 which deals with payment to a different Federal agency. There may be some confusion as to who pays the inventors if the Federal agency does not have a Federal laboratory under its jurisdiction. (The word "the" which would imply a Federal laboratory under its jurisdiction might lead to misunderstanding.)

As a minor point, we noted that the first change to Section 12 of the "Stevenson-Wydler Technology Innovation Act of 1980" uses the word "compensation," while the amendment to Section 14 uses the word "income." We would suggest that the word "compensation" be used with "income" to show that income is compensation after expenses reimbursement.

An additional technical change that IEEE-USA suggests is a change to Section 14, subsection (a)(1)(A)(iii) to read: "The agency or laboratory shall retain the compensation received from intellectual property until the agency or laboratory makes payments to laboratory employees under Clause (i) and in each instance of compensation the payments to laboratory employees under Clause (ii)" because (i) and (ii) both have to be satisfied.

On a more substantive issue, there is the question under Section (a)(1)(B)(i) of the amendment to Section 14 of whether a 15 percent limit on use of compensation for administrative costs is appropriate; especially during the early years of increasing the program participation. This is of concern when it comes to issues of out-of-pocket expenses for filing and maintenance fees with the United States Patent & Trademark Office and with foreign patent offices, especially in the early years of this new methodology.

Based on the numbers in the GAO's recent study on patents, we believe that this may be an unrealistic limit and that at least for the first five years of the program, the 15 percent limit should not be placed on out-of-pocket expenses for maintenance and filing fees; as seems to be implied in the amendment to Section (a)(1)(B)(i).

We would also suggest that (in line with the basic research suggestions that we made at the earlier) the amendment to subsection (a)(2) permit a certain amount of allocation of the 75 percent by the laboratory directly, in order to further basic research, although we realize this would only occur in specific circumstances. It may be appropriate to send a signal to researchers and Federal laboratory directors stating that their research efforts have a priority role in the Federal laboratories when they have extraordinary monetary success. Further, we understand that many of the Federal laboratories are oversubscribed for CRADAs in that the amount of money needed for the Federal side of the CRADA exceeds their budget. Thus, we would suggest that by making part of the 75 percent available to the successful laboratory to use for additional CRADAs not covered by current budgets is additional incentive to the laboratory. Also, the current accounting and allocation may be seen

to interfere with the current methodology used by universities to earn money for themselves through the use of "spawning" private companies with private seed capital. However, we do not view this bill as conflicting with that methodology.

IEEE-USA, believes that the "Technology Commercialization Act of 1993" (S. 1537) will benefit our 22,000 members who are Federal employees as well as many others of our members who work for companies that operate Federal labs. We believe that the incentives provided by this bill will clearly encourage the commercialization of technology. This legislation is also an important step toward encouraging private industry and Federally funded employees to cooperate with one another in using the vast amount of technology generated by the Federal laboratories. "The Technology Commercialization Act of 1993" will enhance U.S. competitiveness and provide rewards to both Federal laboratory inventors and some of its authors -- both of which are priorities of IEEE-USA.

We thank you for the opportunity to share our views on payments to employees funded by Federal monies and the "Technology Commercialization Act of 1993" (S. 1537). I would be happy to answer any questions that you might have.

Senator ROCKEFELLER. The research community within given fields has to be a fairly tight one, whether people are in Federal research or whether they are in private research. People know who they are. They read the journals, they know what they are doing.

Let me ask this to you, sir, Dr. MacLachlan. Do private researchers or people who make decisions for private researchers about funding possibilities or joint venture possibilities, tend to look down on Federal research types, or do they recognize them as being superbly trained? It is a naive question, but I am really interested in the answer.

Dr. MACLACHLAN. Well, there are all kinds of attitudes. But generally speaking, they certainly do not look down at them. But research, even within a company, is of different types. There are the people who do the longer range stuff and are more or less not watched, not under the gun every day to deliver something that has to get to the customer in a year or 6 months, and then there are those that do the more applied work.

And the trick in a company, and I think it really is the same thing going from a company to a Government laboratory, is to connect up those people in a way where they understand each other's needs and problems, and then the technology will flow in that kind of an atmosphere.

Inside my own company, for years the corporate lab, which tended to do the very long-range stuff, was viewed as an ivory tower and not relevant. But in recent years we have made sure they are well connected to the business needs through communications, and the technology starts to flow and each side is—each type of person, scientist or engineer, is doing the same quality work they always did.

I view the problem of technology transfer to or from an outside organization, like a Government lab as being very similar. It is a people-to-people type of operation. Those of us in industry have got to help the Government people, who we know have the basic skills, to understand what aspect of those skills we need to do the things that will satisfy the marketplace. And so there has to be a continuing and substantive communication.

I do not really think, except in rare cases, that it is ideas bubbling up from an isolated laboratory. I think it is ideas bubbling up in an atmosphere of information of what the world needs.

Senator ROCKEFELLER. Yes, sir.

Mr. WELLS. If I could just quickly pick up on what Dr. Good said earlier in terms of the need for a culture change, particularly in our national laboratories in DOE, which we see all the time. Understanding the culture, what these scientists grew up with in terms of the secrecy—these scientists could have gone to jail for what they are talking about today. So, there is a need for a culture change, for retraining and a new atmosphere or operating environment. So, that is a barrier that exists today.

Dr. MACLACHLAN. It is also an advantage in the sense that in working with industry, they will be exposed to our innermost secrets, and their experience in maintaining secrecy is actually quite a help in developing the confidence. So, it is not all bad.

Senator ROCKEFELLER. That is interesting. That is interesting.

Mr. Ostfeld, I think I very cleverly cut you off. And I think I needed to do that because Senator Burns may have some questions, and we just have something called a vote which is going on. Do you have some questions?

Senator BURNS. I have some questions and I want to ask for unanimous consent that my statement will be placed in the record.

Senator ROCKEFELLER. Absolutely.

[The prepared statement of Senator Burns follows:]

PREPARED STATEMENT OF SENATOR BURNS

Mr. Chairman, I want to thank you for holding this hearing on S. 1537, your bill to stimulate more commercialization of the research being performed by our federal labs. Your bill could not be more timely. With the end of the Cold War, the battlefield has shifted to the global marketplace. Recent experience has shown that most of the markets with the greatest potential are in high-tech areas like telecommunications, high-performance computing, advanced materials, and biotechnology.

Our problem in the U.S. has not been in basic research. We remain the world leader in basic research as evidenced by our many Nobel Prize winners in science. Our weakness is in getting our inventions to the marketplace. Time and time again, the United States has developed new technologies only to see them commercialized by other nations. For example, although the United States invented the VCR, it was Japan who further developed that technology into a billion-dollar consumer product.

Another problem that we face is reorienting our federal labs to support commercially relevant technologies that will benefit U.S. industry. The U.S. has a system of over 700 federal labs employing some of the nation's finest engineers and scientists. In FY 1992, the federal government spent about $17.6 billion on in-house research and development by these national laboratories. Unfortunately, many of those labs have been pursuing weapons-oriented missions that have become outdated in this post-Cold War regime. There is a national consensus that we must place greater emphasis on activities to transfer critical technologies from our federal labs to private companies that can transform them into commercial products and processes.

The Cooperative Research and Development Agreements authorized by the Stevenson-Wydler Technology Innovation Act of 1980 have been an important technology transfer mechanism. These CRADAs, as they are called, have enabled federal labs to join with private companies to perform research of clear importance to the private sector. The CRADAs have conducted important research over the years and much of this research has been successfully commercialized.

However, as the Chairman has often stated, it is clear we could do a better job in commercializing federal R&D. According to the Congressional Research Service, only 10 percent of federally-owned patents are ever used. One reason for this is that, under current law, the federal government, not the private sector partner, is assigned the rights to inventions generated under CRADAs. The government may assign those rights to its private sector partner, but it is not required to do so. Accordingly, a private company is not guaranteed any protection against competitors when it commercializes the research to recoup its investment.

Federally-funded university research has had a much better track record in terms of commercializing inventions. With much less investment, universities have generated more patents. One reason for this may be that university research is gov-

erned by the Bayh-Dole Act of 1980, which unlike Stevenson-Wydler, grants ownership rights to the universities, rather than the government. Under the Bayh-Dole system, universities have a greater incentive to work towards commercializing their research than private companies do under Stevenson-Wydler.

S. 1537 amends Stevenson-Wydler by requiring that federal labs assign ownership rights to their private sector partners in exchange for reasonable compensation (for example, royalties). The government would retain an irrevocable, paid-up license to use the technology. S. 1537 should encourage more companies to enter into CRADAs and to work toward developing commercial applications of the work. In most CRADAs, it is the private sector partner that puts in the most money and resources in the R&D and, even after that, the company still has to spend additional millions in product development. A company is unlikely to go to all that trouble if, after producing a commercial product, it has no protection against a competitor copying it.

Mr. Chairman, I am very encouraged by your bill. S. 1537 appears to be a very cost-effective means of accelerating the commercialization of our federal labs' research. It has the potential to increase federal technology transfer without spending additional taxpayers' dollars. That kind of legislation is always welcome. I am looking forward to hearing the testimony of our distinguished panel of witnesses on the bill and any related technology-transfer matters.

Thank you, Mr. Chairman.

Senator BURNS. He lets everybody else make statements but me. But it is really refreshing to work with Senator Rockefeller, especially on this bill, because I think we are going in the right direction. When I was on the Energy and Natural Resources over there and we were trying to write a national energy bill last year, and address in some way the technology that we have done on energy research, on renewables, energy transfer, we did not get to this point where Senator Rockefeller has gotten, and I think he is—I would hope that this would probably accelerate some things that we need to be doing in our energy development here in this country.

I was interested in—Dr. MacLachlan, how many scientists do you employ working with DuPont privately in your R&D?

Dr. MACLACHLAN. It is a little less than 4,000.

Senator BURNS. A little less than 4,000. And this is correct, you have got 125,000 employees.

Dr. MACLACHLAN. Roughly, yes, worldwide.

Senator BURNS. How many working agreements do you have with Governments labs where you are on joint projects?

Dr. MACLACHLAN. We have about 14 right now, CRADA-type agreements.

Senator BURNS. CRADA-type situations.

Dr. MACLACHLAN. We have two people in residence in Government labs now, too.

Senator BURNS. Now, I want to ask you sort of a question. We quit funding and building the supercollider this week. Was that a wise move?

Dr. MACLACHLAN. You have got me at a disadvantage. I am on the board of overseers for the Fermi Laboratory, and in such a capacity was an advocate for high-energy physics. I think it was certainly a great disappointment to the physics community, and certainly it is going to limit that research for decades now. So, I would say in that sense, as representing that community, it was an unfortunate thing. It would have also spawned a lot of new technologies to make the thing work.

Senator ROCKEFELLER. We want you to know that we both voted for it.

Dr. MACLACHLAN. I did not know that, but thank you. You have got me in a delicate spot now.

Senator ROCKEFELLER. He sure did. He slipped that one right out of his sleeve.

Senator BURNS. I think he got me in a delicate spot because I think I voted against it.

We have got about 7½ minutes to make this vote, and I would like to make that because it is awfully important to us in the West. It is awfully important to you, if I could have your attention for a little while, because I need your "no" vote. [Laughter.]

I will get a vote anywhere I want to, and I need it. But I want to thank each and every one of you. I listened to your testimony and I will probably have some more questions. I hope we leave this open for questions as we go along. I happen to be a supporter of this piece of legislation, and I think we are getting toward where we have to be to get it into the marketplace and let market forces drive it, because that is where we get our truest form of acceleration. And thank you for coming today.

Senator ROCKEFELLER. I have got a couple of questions still, one to Dr. MacLachlan. You said that if you got title, that you would get out of the generic research business and then get much closer to the actual——

Dr. MACLACHLAN. We would do both. We certainly would not get out of the generic.

Senator ROCKEFELLER. You would not stop.

Dr. MACLACHLAN. We are very much supportive of the light sources and all that type of thing.

Senator ROCKEFELLER. Yes, which makes an enormous difference in lab culture; does it not?

Dr. MACLACHLAN. Yes, it does.

Senator ROCKEFELLER. In that the testimony here has been so positive and so good. I do not want to take a chance of asking you a question because I may get something negative.

I have some questions I want to submit to the three of you. And I will do that, and I hope you can get it back for me in 2 weeks in writing. They are basic, but important.

Mr. Wells, I cannot thank you enough for this. I mean, I really mean that. Dr. MacLachlan and Mr. Ostfeld, you both have worked for private industry. Now, are you here representing a point of view that is unique to yourselves? I mean is this what Conrad Burns said when he left? He made that point that, OK, well maybe we can do this, but it is the marketplace that has got to drive it.

Dr. MACLACHLAN. No, this is not unique to me.

Senator ROCKEFELLER. In other words, the view that, ultimately, you really cannot trust Government intervention, is deeply embedded in the psyche of the American people, who put up with Government, and certainly in American business.

So, I mean, is this something you discuss with your colleagues?

Dr. MACLACHLAN. Yes.

Senator ROCKEFELLER. They feel the same way?

Dr. MACLACHLAN. Yes, Senator. As I said, I am on the board of overseers for the Fermi. And, in fact, I head up an ad hoc committee on technology transfer, looking at it from the Fermi Lab's point of view. So, I have some understanding of both sides of the issue,

and I do talk to a lot of my colleagues. And I have not asked them specifically on every item in this bill, because there has not been time.

Senator ROCKEFELLER. Right.

Dr. MACLACHLAN. But the sense of what you are trying to do is absolutely in the mainstream and important.

Senator ROCKEFELLER. And then the same with you, sir?

Mr. OSTFELD. Bruce Handler, by the way, is on my committee. And what Dr. MacLachlan said is what I would say.

Senator ROCKEFELLER. Well, I think we are onto something here. I really do. And I regret this vote very much. But your testimony is incredibly important. I have been here for 9 years and this is the first time, in a number of years of trying to get moving on this subject, that people have spoken so clearly, and so unequivocally, and so positively about something which I think is relatively simple, and relatively easy to understand, and relatively possible. So, I thank you all very very much.

[Whereupon, at 4 p.m., the hearing adjourned.]

APPENDIX

Prepared Statement of Senator Pressler

Mr. Chairman, thank you for holding today's hearing on your legislation, S. 1537, the Technology Commercialization Act of 1993. I share your interest in finding ways to increase our nation's technological leadership and international competitiveness. S. 1537 would grant intellectual property rights to private industry working with federal laboratories. The General Accounting Office's statistics seem to be strong evidence that this legislation would increase the rate of turning research and development projects into commercial products.

While I support the goals of this legislation, I have two concerns. First, the federal laboratories are one of the few places where basic research is done. I am sure none of us want to undermine this basic research mission. Second, I wonder how, if at all, the proposed changes would affect incentives of small businesses to work with federal laboratories. I look forward to exploring these issues with our witnesses.

Prepared Statement of the Federal Laboratory Consortium for Technology Transfer

ISSUES RELATED TO S. 1537

S. 1537 proposes an amendment to Stevenson-Wydler that would require that all intellectual property developed jointly by laboratory and private sector employees under a CRADA be assigned to the private sector partner, with the provision that the laboratory receive reasonable compensation. It also requires the private sector partner to license the intellectual property to others on "terms that are reasonable under the circumstances." The amendment also would allow the laboratory to grant licenses for jointly developed intellectual property, under certain circumstances.

Current Stevenson-Wydler provisions are that the laboratory partner may:

> "grant or agree to grant in advance, to a collaborating party, patent licenses or assignments, or options thereto, in any invention made in whole or in part by a laboratory employee under the agreement (a CRADA), retaining a nonexclusive, nontransferable, irrevocable, paid-up license to practice the invention or have the invention practiced throughout the world by or on behalf of the government and such other rights as the Federal laboratory deems appropriate."

SUMMARY

Despite the good intentions of the proposed amendment to promote industry and government laboratory partnerships, it could actually impede domestic technology transfer for a number of reasons. In the spirit of the proposed amendment, an alternative is presented that provides greater benefits to industry and does not impede technology transfer.

CONSIDERATIONS

If the intent of this proposed amendment is to give ownership of jointly developed intellectual property to a collaborating CRADA party, it should be noted that, the collaborating party already has an ownership interest in jointly developed inventions and other intellectual property based on the contribution of their employees. The government or its laboratory also has ownership, which would not prevent a collaborator from commercializing technology. By law, the collaborating party, in the absence of any agreement to the contrary, may make, use or sell the patented invention or other intellectual property without the consent of and without accounting to the other owners.

Although the proposed legislation is intended to simplify CRADA negotiations and to make CRADAs more attractive to the private sector, it might have the opposite

effect. It also may reduce motivation of laboratory inventors and creators of all other intellectual property by decreasing their incentives. It will reduce the ability of government laboratories to promote the widest possible applications of government supported technology.

Most importantly, the "best practice" that is evolving among government laboratories is to grant exclusive licenses to private sector companies for one or more fields of use with performance criteria written into the licensing agreements. This promotes the widest possible commercialization of technology by protecting the commercial positions of private companies while also preventing unproductive monopolization of rights to technology. If performance criteria are not met, exclusive licenses may be revoked and the technology licensed to another company. Exclusive licenses for specific fields of use are particularly effective, because CRADA partners usually commercialize a technology for a specific product and have little or no capability or intent to market and license it for other uses. Most companies do not have aggressive intellectual property management and licensing programs to license technology to other companies. In fact, most companies will readily admit that they never actively seek licensees for any of their intellectual property, hence it is unrealistic to expect most companies to license intellectual property created jointly with laboratory inventors under CRADAs. The most effective way to make intellectual property available to other companies for specific, non-competing applications is for the federal laboratory to license it for those applications.

Presently, laboratories may have multiple CRADAs in place in the same technical area and even involving the same laboratory employees. This is possible when 1) the companies are focused on commercializing different products, and 2) laboratory employees are careful to avoid any "cross fertilization" between CRADAs. Agencies and laboratories can achieve these conditions, if they are very deliberate in setting up the CRADAs. Recently, the Naval Air Warfare Center at China Lake established the Embedding Computing Institute (ECI) as a focal point for cooperative ventures. Four CRADAs are in place, with more expected. Another example is with an energy efficiency technology, where the Department of Energy's National Renewable Energy Laboratory (NREL) is working under separate CRADAs with two companies on unrelated applications of this technology. The CRADAs call for NREL to license each industrial partner for its area of application of the common technology. If S. 1537 applied, NREL would have to cancel one agreement and forego the commercialization for that application.

Another serious concern is the issue of government march-in rights. Under government contracts, the government retains march-in rights, much like those proposed in S. 1537, Section 3(4) (A) through (D). Historically, these have rarely, if ever, been exercised largely because of the resources required to do so. This history is very important to the success of technology transfer from the Department of Energy's (DOE) government-owned, contractor-operated (GOCO) laboratories, which carry out a significant portion of federal laboratory research. All GOCO laboratory agreements licensing laboratory intellectual property to other parties necessarily disclose the government march-in rights that exist in the GOCO operating contracts with the government. Also, all DOE CRADAs include march-in rights. Companies are immediately distrustful of licensing agreements and CRADAs that include government march-in rights. If S. 1537 does become law and the departments and agencies begin to exercise march-in rights, then GOCO laboratories will have an exceedingly difficult time convincing potential licensees that they need not fear march-in rights.

The government march-in rights proposed in S. 1537 are likely also to cause concern to potential CRADA partners, because the march-in rights would be triggered according to interpretations of such phrases as "responsible applicant" and "terms that are reasonable under the circumstances." Both businesses and government are better served by well written licensing agreements that follow best commercial practices and, therefore, cover situations that may call for revocations or other modifications of licenses. Such licensing agreements would obviate the need for such heavy handed measures as march-in rights.

If reducing the time to negotiate a CRADA is an objective of S. 1537, this is unlikely to be the case. If the amendment were to be enacted, the smart government negotiator would negotiate the terms of the assignment of any intellectual property before entering into the CRADA to avoid the extremely weak position of negotiating "reasonable compensation" for rights that the law already has awarded to the private sector partner. The only time the government negotiator has leverage, therefore, is while negotiating the CRADA. Thus, the terms of not one but two legal documents, the CRADA and the assignment, would be negotiated at once. Furthermore, since the private sector partner would also be expected to license the intellectual property for other fields of use, the "reasonable compensation" sought by the govern-

ment negotiator might well exceed that thought reasonable by the partner. The government negotiator may be seeking compensation for all fields of use from the potential CRADA partner, who may have little knowledge of the value of the yet-to-be created intellectual property in fields of use outside the CRADA partner's business experience.

Another reason for concern regarding the provisions of S. 1537 is that problems may arise with some collaborators who have been assigned intellectual property under the proposed amendment. In the case of bankruptcy or sale to a foreign corporation, the assigned intellectual property would be considered company assets and be subject to transfer to a foreign corporation without regard to prior government interest in it. If, instead, joint ownership were retained, the negotiated exclusive licensing agreement could specify under what circumstances the agreement would be terminated.

AN ALTERNATIVE APPROACH

An alternative approach that may meet at least some of the objectives of the proposed amendment would be to require that the private sector CRADA partner be given the right of first refusal for royalty-bearing exclusive licenses of intellectual property created in whole or in part by a laboratory employee under a CRADA for the specific field of use contemplated in the CRADA partner's present and planned business interests. This would guarantee an opportunity for exclusive licenses to the private sector partner; it would also provide for application of technologies in fields of use not of interest to the CRADA partner.

This alternative approach would also provide a much simpler means of rewarding laboratory inventors as mechanisms are already established for royalty sharing, based on current law. Continuing to use licensing as a means of compensating the government would also be advantageous, as royalty sharing under licensing is customary in the commercialization of intellectual property, where payments are directly proportional to success in the marketplace.

This alternative approach has a major advantage over both existing law and S. 1537, inasmuch as the collaborating partner is guaranteed an opportunity for exclusive licenses in the collaborator's field(s) of use of all intellectual property developed under the CRADA that is not already solely owned by the collaborator. In particular, it guarantees an opportunity for exclusive rights to intellectual property developed solely by laboratory employees, which may, in many cases, be very valuable to the CRADA partner. This position likely will enhance the atmosphere for collaboration, reducing tensions regarding ownership of intellectual property.

The alternative approach provides these benefits without hindering technology transfer applications for other fields of use, hence, would promote maximum value to the American economy from taxpayers' investments in federal laboratories.

QUESTIONS ASKED BY SENATOR ROCKEFELLER AND ANSWERS THERETO BY MR. WELLS

Question. You said federal scientists are subjected to hassles when they want to patent an invention. How will the bill's rules on the distribution of intellectual property income affect the hassles and, thereby, increase technology commercialization?

Answer. Currently, technology transfer programs provide almost no benefits at the laboratory-level and, therefore, little motivation for lab management to make changes that will facilitate and encourage patenting. The proposed changes in the bill should help change that. First, the bill's new distribution-of-income rules make the up-front payments to inventors substantially larger. If fewer scientists are disappointed with the size of the rewards paid by royalty sharing, more scientists would be motivated to report their inventions and deal with the hassles involved in technology transfer. Secondly, by limiting the amount of income that can be used for administrative-type expenses to 15 percent, more of the income will be available for science-related purposes in the laboratories where they will be more visible to the scientists. The benefits become tangible...something the scientists can use or put their hands on. Channeling more money back into the labs should also motivate more lab directors and potential inventors to seek to commercialize their technology.

Going beyond S. 1537, we believe agencies also need to address the various procedural impediments noted in our report, such as providing more information and training for lab scientists on the kinds of subject matter that is patentable and support to "walk scientists through" the administrative process. These kinds of changes do not require legislative actions but talking about them here may be useful in encouraging agencies to initiate actions to address these problems.

Question. Your report describes a culture in federal labs that discourages collaboration with U.S. industry and technology commercialization. What can we do to change that culture?

Answer. In the past, the culture in federal laboratories did not hold collaboration with industry or commercialization in high regard. Provisions, such as S. 1537's increase in up-front royalty payments and limit on the amount of royalties that can be used for non-scientific or administrative purposes, are an important first step. Channeling more benefits into the laboratories for potential inventors should also improve the lab's culture for collaboration.

Further, the scientist who wants to patent an invention is generally faced with ad-hoc committees that decide which invention ideas the agency will patent. Scientists submit their invention ideas to these committees which in many instances meet maybe only once or twice a year and whose membership is subject to the politics of the lab. There is little timely gratification for the enthusiastic and creative inventor. The culture of the lab still prizes publication over commercialization. Peer recognition through publication is still a very strong motivating force in the behavior of the scientists. in that regard, NASA has another approach to publicizing scientists' ideas through publications. NASA sponsors a monthly journal entitled "Tech Briefs." The journal is professionally done and receives wide distribution outside the federal government in industry and at other agencies. Scientists inside and outside NASA said that they find the peer recognition from this kind of publication gratifying.

Question. In U.S. universities, when one researcher makes some big bucks from the commercialization of an invention, other researchers become much more interested in the patent process. Will the same thing happen in federal labs?

Answer. In general, technology that earns large incomes for federal inventors should stimulate other federal scientists to consider collaboration with industry. However, federal agencies and laboratories have some additional concerns that impede, or are a cause for concern for federal scientists when they want to commercialize technology. For example, federal scientists don't have the same independence that university scientists have for entrepreneurship by licensing, or marketing, their technology to industry. In addition, to a greater extent than their counterparts at universities, conflicts-of-interest questions arise if a federal scientist develops a financial relationship with a company and at the same time receives a salary for working for the government. Finally, the licensing process within the government is slower than at universities. The government, more than universities, must ensure that all parties interested in making, using, or selling technology developed with federal money have a fair opportunity to license it.

Question. Do the bill's provisions for "reasonable compensation," government-use, and march-in rights protect the public's interest in the jointly-developed technology?

Answer. A key to the success of such provisions will be whether they are properly implemented and administered. As with other government programs, good management and adequate oversight are very important.

QUESTIONS ASKED BY SENATOR ROCKEFELLER AND ANSWERS THERETO BY MR. OSTFELD

Question. How will the bill's income sharing provisions affect the 22,000 members of the institute of Electrical and Electronics Engineers who are Federal employees and the many members who work for companies that operate Federal labs?

Answer. IEEE-USA believes that there are many talented scientists and engineers working in Federal labs who deserve adequate rewards for income to the United States derived from their innovations and hard work. They develop technology that is valuable to private industry. We believe S. 1537 will provide further incentives for Federal labs to develop, and make available for transfer, technology to private companies through the bill's income sharing plan.

The Technology Commercialization Act of 1993 (S. 1537) will provide an excellent compensation plan to the Federal employees by offering the first $10,000 earned by the United States per intellectual property per project with further compensation after that. We believe that this compensation scheme is extremely fair and will further encourage Federal employees and labs to work jointly with private industry to commercialize important technologies.

However as we mentioned in our testimony, we are concerned that there may not be enough of an incentive in S. 1537 to encourage companies that operate Federal labs to provide the necessary financing to file patents on behalf of their employees. We have suggested that a mechanism be implemented so that the operator company will not have to expend an excessive amount of its capital for patent filing costs.

Question. Most of your organization's 240,000 members do not work for Federal labs, but for U.S. industry. Do you believe S. 1537 will encourage greater collaboration between U.S. industry and the Federal laboratories?

Answer. We have talked with many engineers in private industry who have informed us that present law provides little incentive to industry to enter into CRADAs or technology transfer agreements that requires significant investment. This is especially true when copyrightable material is involved. Because the Federal government is prohibited from receiving copyright for any material it produces, private firms working under a CRADA or involved in technology transfer cannot receive any copyright protection on their products developed under a CRADA.

Although the present law (Stevenson-Wydler) offers patent protection under a CRADA, it does not go far enough. The Technology Commercialization Act of 1993 goes one step further by assigning patents and copyrights (for GOCOs) to private firms involved in a CRADA or a technology transfer program. We believe that if private companies can be assured that the underlying research technology can be protected by patents and copyrights, private industry will have greater confidence that they will be able to protect their developments of commercial products. Thus, they will be more willing to engage in these arrangements with the Federal government.

QUESTIONS ASKED BY SENATOR ROCKEFELLER AND ANSWERS THERETO BY DR. MACLACHLAN

Question. Why is the control of the inventions or other intellectual property important to companies like DuPont?

Answer. Control of intellectual property is our competitive edge. It also provides an opportunity for the private industry partner in a CRADA to recover its investment, justify the commitment of its researchers, and encourages commercialization and future investment. Without control of the inventions or other intellectual property discovered in a CRADA, the private industry partner has no incentive to commercialize, knowing that it could very well spend hundreds of millions of dollars taking a new technology to the marketplace only to find its competitors there as well with the same technology—technology obtained by reverse engineering of our products or some similar route.

Question. Does the practice of many Federal laboratories to license jointly-developed technology for only a limited field of use affect your company's willingness to enter into a cooperative R&D agreement?

Answer. The practice of licensing jointly developed technology for only a limited field of use can make a cooperative agreement less desirable in some instances. DuPont, for example, has often done research in one field and later applied that knowledge to another field that may be an even greater commercialization success. Inventions come from the integration of technology, and if a company builds a world scale plant, it wants to fully utilize it. "Keviar", for example, was initially produced to replace nylon and glass cord in tires; today, it is used in bullet-resistant vests and structural composites.

The limited field license could result in an industry partner losing ownership and control over a technology it helped develop. This would be especially undesirable if the jointly developed technology was an outgrowth of the technology the industry partner brought to the CRADA.

Question. Some Federal labs fear that companies are unlikely to make full use of the technologies they obtain through CRADAs. is that a valid fear? Do you believe that the bill's "march-in rights" will prevent companies from "sitting on the technology"?

Answer. The fear that industry partners are unlikely to make full use of technologies obtained through CRADAs is not completely valid. The commercialization of any technology has to be based on business considerations of revenue, business growth and profitability. Business needs and marketplace interests can change. Sometimes it is not technically feasible to commercialize; other times there may be resource limitations. Commercialization for commercialization's sake is not good business.

I believe the provisions in S. 1537 regarding "march-in rights" should be modified to reflect more the cooperative nature of a CRADA. As currently stated the bill's "march-in rights" will, in my opinion, deter private industry partners from participating in CRADAs. Unlike procurement environments where "march-in rights" serve the purpose of encouraging and maintaining the technology developed with government funds, CRADAs are joint development agreements through which the industry partner is not compensated for its work.

Question. Will the provisions of S. 1537 make it easier to negotiate a cooperative R&D agreement?

Answer. Easier is a relative term. It will certainly add to the conviction of the industry partner that the view is worth the climb. Over time it should also become easier, but initially there may be some learning to be done.

Question. Are your views widely shared among U.S. corporations?

Answer. I cannot broadly state this, but recent polls of the membership of the Industrial Research Institute, Inc. (IRI) showed concerns that were consistent with, if not identical to, the obstacles Senator Rockefeller cited as his reasons for sponsoring S. 1537. I have discussed this issue with industry colleagues as well as fellow managers in DuPont who deal with CRADAs, and they support the concepts expressed in S. 1537.

Question. Do you think Federal laboratories directors are better able to decide what technologies should be commercialized, or how they should be commercialized, than technology managers from American industry?

Answer. Although federal laboratory directors, like their industry counterparts, have extensive experience and expertise in research and the discovery of new technologies, they should not be given the responsibility to unilaterally decide how, when or where technologies discovered in CRADAs should be commercialized. Federal laboratory directors can be instrumental in setting some direction and general parameters, but the fundamental decisions of development and profitability are driven by business considerations. In industry, research directors participate in the decision, but do not have sole authority.

Similarly, the laboratory director has a role with regard to the "march-in rights" provisions outlined in S. 1537, but I believe procedures should be put in place to reflect more the cooperative nature of a CRADA. I do not believe it is appropriate to use procurement procedures and safeguards in a cooperative development agreement.

QUESTIONS ASKED BY SENATOR PRESSLER AND ANSWERS THERETO BY DR. MACLACHLAN

Question. Our federal laboratories are still one of the few remaining places where basic research is done. This nation's technological strength has been based on its leadership in basic science. I am sure none of us would want to undermine this capability. In your opinion, what effect would the proposed legislation have on the numbers of scientists choosing to pursue applied, as opposed to basic, research?

Answer. I do not expect S. 1537 to have any impact on the choice of research by scientists. Some scientists are naturally drawn to basic research and are good at it. Financial incentives are unlikely to direct many of these people, especially in their early and most productive years. There may be some flight of federal lab scientists to universities if they can gain funding. Within limits, this might be an acceptable shift.

Question. DuPont's prepared statement says that S. 1537 would encourage more extensive participation of companies like DuPont in Cooperative Research and Development Agreements with federal labs. In your opinion, would it also encourage more participation by small business?

Answer. Yes. The ownership of intellectual property rights provisions in the proposed bill should encourage more participation by small business for the same reasons these provisions would encourage more extensive participation of companies like DuPont. In some situations it may be more important to small businesses because the only competitive barrier they may have might be the patent. In large, more established industries, patents are also crucial, but often broad market presence, capital intensiveness, access to volume discounts on raw materials and many other similar functions can help improve competitiveness.

QUESTIONS ASKED BY SENATOR BURNS AND ANSWERS THERETO BY DR. MACLACHLAN

Question. Most agree that the United States could do a much better job of commercializing R&D from our system of 700 federal laboratories. How much of the problem is our failure to give ownership rights to inventions to private companies participating in joint research with the labs? What are some of the other reasons why the U.S. has been unable to convert more of our federal R&D into commercial goods and services?

Answer. A significant part of the problem is the failure to give ownership rights to inventions to private companies participating in joint research with the federal laboratories. As I stated in my testimony, control of intellectual property is our com-

petitive edge. It also provides an opportunity for the private industry partner in a CRADA to recover its investment, justify the commitment of its researchers, and encourages commercialization and future investment. The other reasons why the U.S. has been unable to convert more federal R&D into commercial goods and services include the lack of effective mechanisms to link the labs to the external marketplace and the length of time and commitment of resources required to finalize a CRADA.

Question. S. 1537 seeks to stimulate commercialization of federal research by assigning to private companies the ownership rights to inventions developed in joint research projects. If enacted, what impact do you think S. 1537 will have on commercialization of federal labs' R&D? What is your assessment of the current system of Cooperative Research and Development Agreements (so called CRADAs) which govern joint government-industry research today?

Answer. As I stated in my testimony, the provisions in S. 1537 to assign to private companies the ownership rights to inventions developed in joint research projects will encourage more extensive participation of companies like DuPont in CRADAs and speed the commercialization of U.S. advanced technologies—keys to both our country's international competitiveness and the creation of new, high quality jobs here at home.

The establishment of a CRADA is, from our point of view, often difficult. In many cases it has taken well over a year to negotiate a successful CRADA. And because the current law gives government laboratories an option to claim ownership to technology developed jointly by a laboratory and a private research partner, we have restricted ourselves to generic technologies. There is no incentive to do anything other than general research. There is little question that complications over intellectual property rights are often the main sticking point during CRADA negotiations.

Question. It is my understanding that under the current CRADA system, too much time and effort is consumed by negotiations between the private company and federal labs regarding the allocation of ownership rights to their joint research. In your view, how significant is that problem? What is the experience of the typical private company today that seeks to do joint research with a federal lab? What bureaucratic barriers do the private companies face in dealing with the federal labs?

Answer. The amount of time necessary to negotiate a CRADA is a significant impediment in working with the federal labs. We have, for example, invested more than 10 person-years in negotiating the 16 active CRADAs in which we are participating. The DuPont negotiator has considerable delegated authority and the ability to get additional information quickly when uncertain about an issue. In our experience, the government negotiator must prepare a written position proposal and wait 20 to 30 days for a response from within the government, and repeat the process with each issue that comes up. Bureaucratic barriers include government negotiators who have no decision-making authority and who don't understand the transfer technology legislation, and the need to involve numerous field and Washington offices.

Question. The bill calls for the federal labs to assign to their private sector partners the ownership rights to CRADA-generated inventions in exchange for "reasonable compensation." In your view, what types of "reasonable compensation" are the labs and the companies likely to negotiate?

Answer. Although it is difficult to speculate about the types of reasonable compensation that labs and companies are likely to negotiate, historically reasonable compensation has meant royalties and licensing agreements. Considering the factors that are usually taken into account when calculating royalties—the value of the invention, the importance of the invention, the scope of the invention, the degree of participation in the invention, etc.—it would be difficult to negotiate reasonable compensation before we know the value of the end result. Our agreements with university laboratories, for example, usually include a clause such as "agreeing to negotiate in good faith to determine a reasonable royalty rate which will take into consideration the contribution of each party, the proprietary position provided and the profit potential."

Question. S. 1537 also strengthens the financial incentives for lab scientists to report and patent their inventions. A December 1992 GAO Report found that the current royalty-sharing system has not increased scientists' interest in patenting inventions. The Report concluded that very little of the royalty income to the labs was directed to the individual scientists. It also concluded too much of the royalty income was being spent on administrative overhead, rather than lab research. Do you agree with these criticisms? In your opinion, does S. 1537 adequately address these problems?

Answer. As I have not read the GAO report referenced, I cannot comment on its findings. During my 36 years in research and development, I have found that most scientists are more motivated by recognition of their achievements than by financial

incentives, especially when the financial reward comes many years after the research accomplishment has been made. For a year during the 1970s I directed the DuPont R&D lab in Germany. There, it is the law that when a scientist is awarded a patent he or she also receives financial compensation related to the commercial value of the patent. This is definitely motivational. S. 1537 does provide for the scientist who makes the discovery in CRADA research to receive financial compensation. In my opinion, this financial incentive will be a motivating factor if the monetary amount is substantial as recommended and awarded quickly.

Question. The bill also provides for so-called "march-in" rights enabling the federal government to license technology to another company if the company to whom title is given does not commercialize the technology in a timely manner. How significant is the problem of a private company failing to commercialize technology which it owns?

Answer. The commercialization of any technology has to be based on business considerations of revenue, business growth and profitability. Business needs and marketplace interests can change. Sometimes it is not technically feasible to commercialize; other times there may be resource limitations. Commercialization for commercialization's sake is not good business.

I believe the provisions in S. 1537 regarding "march-in rights" should be modified to reflect more the cooperative nature of a CRADA. As currently stated the bill's "march-in rights" will, in my opinion, deter private industry partners from participating in CRADAs. Unlike procurement environments where "march-in rights" serve the purpose of encouraging and maintaining the technology developed with government funds, CRADAs are joint development agreements through which the industry partner is not compensated for its work.

Question. In addition to the legislative changes that S. 1537 would make, what other changes in the law would you recommend to improve our system for transforming federal R&D into commercial goods and processes?

Answer. This is an issue that requires in-depth thought and discussion. Many of our concerns could be addressed through changes in how existing legislation is interpreted rather than through actual legislative changes. I do believe that technology is primarily transferred through people to people contact and by people who have access to real business needs. This suggests to me that more intermingling of government and industrial scientists will be needed to really increase the effective transfer. Whether this is practical or not remains to be seen. If we cannot do this, I question the current level of government lab funding.

Question. We spend about $20 billion annually on the in-house R&D performed by our system of 700 federal labs. Unfortunately, many of those labs pursue defense-oriented missions that have become obsolete in this post-Cold War era. How difficult is it for U.S. industry to find commercial applications for defense-oriented lab research?

Answer. Again, this is a topic that requires considerable thought and discussion perhaps better addressed in a separate forum. DuPont is participating in the Technology Reinvestment Program (TRP) to find new uses for its defense-based technology. Perhaps there is a role for the federal labs in this federally-sponsored program.

Question. Federally-funded university research is often cited as an example of the effective commercialization of federal R&D. The reason for that success is thought to be that universities doing such research are assigned ownership rights. What is your assessment of the rate of commercialization of federally-funded university research?

Answer. First of all, it's important to recognize that only 12 to 15 percent of research gets commercialized. University research has been successful in its rate of commercialization for several reasons. First, most university laboratories are in large, important cities close to major high-technology business centers. Second, most academic researchers have ties to industry and university students and post doctoral candidates move in a steady stream into companies where there is interest in the technology that is being discovered. Also, legislation covering federally-funded university research has provisions to assign intellectual property rights to the private industry partner in joint research projects.

QUESTIONS ASKED BY SENATOR BURNS AND ANSWERS BY MR. WELLS

Question. Most agree that the United States could do a much better job commercializing research and development (R&D) from our system of 700 federal laboratories. How much of the problem is our failure to give ownership rights to inventions to private companies participating in joint research with the labs?

Answer. In my statement before the Subcommittee, I noted that we are uncertain what impact assigning title to intellectual property to Cooperative Research and Development Agreement (CRADA) collaborators would have on the overall process because our report did not address this issue. Specifically, we are not aware of the extent to which federal laboratories are presently giving title to, or withholding title from, their collaborators. Furthermore, we do not know how often federal laboratories and potential collaborators have fundamentally disagreed about title rights or whether such disagreements substantially lengthened, or caused companies to drop, CRADA negotiations.

Question. What are some of the other reasons why the U.S. has been unable to convert more of our federal R&D into commercial goods and processes?

Answer. While we have not surveyed U.S. businesses to develop a comprehensive list of reasons why federal laboratories have had problems converting their R&D into commercial goods and processes, the following issues have been highlighted by our research or cited by those we have interviewed during the course of our work:

- Federal laboratory R&D is important for fulfilling an agency's mission, but much of this R&D and many resulting inventions have little potential commercial application.
- Many businesses have little or no knowledge about how to access the resources within federal laboratories or opportunities to collaborate with federal scientists.
- Because of rapidly changing technologies and highly competitive markets, businesses need to negotiate agreements relatively quickly. Many businesses believe that taking 6 months—or more—to negotiate an agreement is inordinately long and will opt to commit their resources to another R&D project to develop another technology. And
- As stated in our report and testimony, managers at several federal laboratories have not taken actions to remove procedural impediments that exist when a scientist wants to patent an invention because they do not perceive any benefits from royalty sharing accruing to other scientists or their laboratory's R&D program.

Question. S. 1537 seeks to stimulate commercialization of federal research by assigning to private companies the ownership rights to inventions developed in joint research projects. If enacted, what impact do you think S. 1537 will have on commercialization of federal labs' R&D?

Answer. As noted previously, we are uncertain what impact assigning title to intellectual property to CRADA collaborators would have on the commercialization of federal research.

Question. What is your assessment of the current system of CRADAs, which govern joint government-industry research today?

Answer. CRADAs are only one of a number of mechanisms available to federal laboratories to transfer their technology. However, CRADAs differ from other ways of transferring technology in that they are flexible to meet the needs of different laboratory cultures and R&D missions. One of the basic points in my testimony statement on June 10, 1993 before the Subcommittee on Energy, House Committee on Science, Space and Technology, is that agencies have used the statutory flexibility differently. For example, according to officials from the Department of Energy's (DOE) its approach to CRADAs was based on authority from earlier legislation which permitted DOE to do work for others in return from financial reimbursement. As a result, DOE's implementation procedures for CRADAs were drawn from some financial contract arrangements like contracts, grants, and cooperative agreements. In contrast, the National Institute of Standards and Technology (NIST) and Army view CRADAs as collaborations for mutual problem solving and sharing benefits. In summary, because federal agencies have taken different approaches—and some of these approaches are under review and may be modified—it is too early to tell if CRADAs will be "the answer" for stimulating more commercialization of federal technology.

Question. It is my understanding that under the current CRADA system, too much time and effort is consumed by negotiations between the private company and federal lab regarding the allocation of ownership rights to their joint research. In your view, how significant is that problem?

Answer. Although we did not assess the specific time and resources used to negotiate ownership rights for a CRADA, our work for the previously mentioned testimony found that some agencies' practices do result in longer times to implement their CRADAs. For example, during 1991 and 1992, DOE's government-owned, contractor-operated (GOCO) laboratories we surveyed for previously mentioned testimony typically took 7.5 months from the time one company expressed an interest in entering into a CRADA until the company and that laboratory could begin the collaboration. In contrast, laboratories at NIST and Army averaged 1.5 and 3 months, respectively, to implement a CRADA.

Question. What bureaucratic barriers do the private companies face in dealing with the federal labs?

Answer. As the above time frames indicate, there are substantial differences between agencies in the ease with which CRADAs are negotiated and approved. NIST and Army have a streamlined, decentralized implementation process, while DOE relies heavily on its Washington, D.C., headquarters to make decisions.

Question. The bill calls for the federal labs to assign to their private sector partners the ownership rights to CRADA-generated inventions in exchange for "reasonable compensation." In your view, what types of "reasonable compensation" are the labs and companies likely to negotiate?

Answer. It is hard to anticipate the ways federal agencies and businesses might respond to what constitutes "reasonable compensation." However, two basic approaches companies and federal laboratories are likely to take in negotiating compensation are (1) an upfront reimbursement of costs or (2) a royalty payment based on commercial sales from the product or process. Some factors that might dictate the approach for compensation are the company's cash position, a need to recover laboratory costs, and/or the anticipated success for the product or service.

Question. S. 1537 also strengthens the financial incentives for lab scientists to report and patent their inventions. A December 1992 GAO report found that the current royalty-sharing system has not increased scientists' interest in patenting inventions. The report concluded that very little of the royalty income to the labs was directed to the individual scientists. It also concluded too much of the royalty income was being spent on administrative overhead, rather than lab research. Do you agree with these criticisms? In your opinion, does S. 1537 adequately address these problems?

Answer. As I stated in my testimony, we strongly support S. 1537's provisions to increase the up front royalty payments to inventors and place a limitation on the amount of remaining income used for non-scientific purposes. We believe that these provisions clearly address our report's findings and recommendations and should stimulate federal scientists' interest in reporting inventions, and motivate laboratory directors to encourage technology transfer.

Question. The bill also provides for so-called "march-in" rights enabling the federal government to license technology to another company if the company to whom title is given does not commercialize the technology in a timely manner. How significant is the problem of a private company failing to commercialize technology which it owns?

Answer. Generally, march-in rights (also known as diligence clauses) are important for protecting the government's, and in turn the public's, interest because it enables the government to seek alternative companies that are interested in commercializing a technology. As an example, we discussed diligence clauses during interviews with technology licensing specialists at Harvard, MIT, Stanford, and the University of California in 1991. These licensing specialists stated that their universities routinely include diligence clauses in their licensing agreements with specific milestones and periodic reporting requirements to track the licensee's efforts to commercialize the technology. The licensing specialists stated that the four universities had exercised the diligence clause in only a few cases, typically after a company had decided it was no longer interested in pursuing commercialization of the licensed technology.

Question. In addition to the legislative changes that S. 1537 would make, what other changes in law would you recommend to improve our system for transforming federal R&D into commercial goods and processes?

Answer. Our 1988 report entitled "Technology Transfer: Constraints Perceived by Federal Laboratory and Agency Officials" (GAO/RCED88-89BR) stated that businesses were less inclined to collaborate with federal laboratories or license federal technology because (1) federal laboratories generally could not conduct proprietary R&D, enabling competitors to get access to research results; (2) DOE's GOCO laboratories were required to obtain DOE approval, creating uncertainty and time delays; (3) federal agencies could not copyright computer software, reducing a business's incentive to develop and market it; and (4) federal laboratories may institute burdensome or time-consuming procedures in their efforts to be fair in providing businesses with opportunities to collaborate on R&D. The Congress has enacted legislation to address the first two issues and currently is considering further legislation to stimulate technology transfer from DOE's GOCO laboratories. Regarding the third issue, our June 1990 report entitled "Technology Transfer: Copyright Law Constrains Commercialization of Some Federal Software" (GAO/RCED-90-145) suggested that, to effectively transfer and use federal computer software while accommodating concerns about access to federal data bases and federal laboratories' basic research mission, it may be appropriate to provide copyright and licensing authori-

ties for federal software with wider commercial applications that need further investment to be effectively transferred. Subsequently, legislation was introduced to enable federal agencies to copyright computer software developed as part of a CRADA; however, this legislation has not passed. Regarding the fourth issue, stimulating technology transfer and ensuring fairness in providing businesses with opportunities to benefit from federal technology are both important objectives that unfortunately conflict in some ways.

Question. We spend about $20 billion annually on the in-house R&D performed by our system of 700 federal labs. Unfortunately, many of those labs pursue defense-oriented missions that have become obsolete in this post-Cold War era. How difficult is it for U.S. industry to find commercial applications for defense-oriented lab research?

Answer. We have not assessed the potential for commercial applications of defense-oriented laboratories' technology. We would note that much of both DOE and DOD technology is classified, and defense laboratories must ensure security and non-proliferation requirements are met before the technology is transferred for commercial use. Despite' these constraints, the Army has been quite successful in collaborating with industry through CRADAs. In addition, a recent study, "Patterns of Industry Interaction with Federal Laboratories" by Professors J. David Roessner and Anne Wise from the Georgia Institute of Technology, suggests that companies prefer to interact with federal laboratories for the access to unique technical resources, including the expertise of their scientists and specialized R&D facilities. In such cases, because the technology or information sought is not application-specific, a defense-oriented laboratory is less hampered by security concerns.

Question. Federally funded university research is often cited as an example of the effective commercialization of federal R&D. The reason for that success is thought to be that universities doing such research are assigned ownership rights. What is your assessment of the rate of commercialization of federally-funded university research?

Answer. We have issued several reports on agencies' implementation of the 1980 law—commonly known as the Bayh-Dole Act—that allowed universities to elect to retain title to inventions developed with federal funding. University officials we interviewed have cited the importance of these title rights provisions for stimulating their technology licensing programs since 1980. Our May 1992 report entitled "University Research: Controlling Inappropriate Access to Federally Funded Research Results" (GAO/RCED-92-104) found that 35 universities we surveyed generally had substantially expanded their programs to transfer technology to businesses during the 1980s. During fiscal years 1989 and 1990, these universities granted 536 licenses and received $82 million in income for technologies developed in whole or in part with NIH or NSF funding. In negotiating sponsored research agreements with industry, these universities generally retain title to any intellectual property developed during the course of research while giving the business sponsor the right to negotiate a license.

QUESTIONS ASKED BY SENATOR PRESSLER AND ANSWERS THERETO BY MR. WELLS

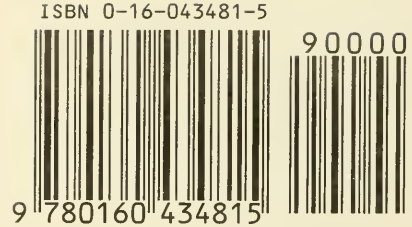
Question. Our federal laboratories are still one of the few remaining places where basic research is done. This nation's technological strength has been based on its leadership in basic science. I am sure none of us would want to undermine this capability. In your opinion, what effect would the proposed legislation have on the numbers of scientists choosing to pursue applied, as opposed to basic, research?

Answer. In our December 1992 report entitled "Technology Transfer: Barriers Limit Royalty Sharing's Effectiveness" (GAO/RCED-93-6), we conducted a number of focus groups with scientists and engineers who are engaged in various stages of R&D at federal laboratories across the country. They told us that they choose to do research because it allows them to be creative and offers independence—not because it pays them high salaries. Furthermore, they told us that they do not report inventions in the hopes of receiving a financial reward. Given this "nonfinancial-based" value system, the decision to abandon basic research for applied research or technology commercialization seems unlikely. In addition, because federal scientists who perform-basic research are just as free as other scientists to invent and protect their intellectual property with patents, there may not be cause for concern.

Question. DuPont's prepared statement says that S. 1537 would encourage more extensive participation of companies like DuPont in Cooperative Research and Development Agreements with federal labs. In your opinion, would it also encourage more participation by small business?

Answer. Because we have not done any specific work on the issue of assigning title, we are uncertain whether this provision would also encourage small businesses to participate in CRADAs. However, concerns about title ownership may not be a function of whether a business is big or small. Rather, it may depend upon the importance of an invention for the company's products. For example, we were told during our work for the October hearing that businesses that have funds and can afford to protect their intellectual property with patents or copyrights will generally do so. On the other hand, in some instances a company needs only short-term use of a technology. Such access can be achieved less expensively through a non-exclusive license, thus making control through ownership a less important issue.

○

BOSTON PUBLIC LIBRARY
3 9999 05982 112 2

ISBN 0-16-043481-5